



ಬಿ.ಎಂ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ

(ಸ್ವಾಯತ್ತ ವಿದ್ಯಾ ಸಂಸ್ಥೆ)

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU)

**Medical Electronics
Scheme & Syllabus
(2010-2011)
(2011-2012)**

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ಬುಲ್ ಟೆಂಪಲ್ ರಸ್ತೆ, ಬೆಂಗಳೂರು-560 019

BMS COLLEGE OF ENGINEERING

Bull Temple Road, Bangalore - 560 019



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU)

VISION

Promoting Prosperity of mankind by augmenting human resource capital through quality Technical Education & Training

MISSION

Accomplish excellence in the field of Technical Education through Education, Research and Service needs of society



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19

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DEPARTMENT OF MEDICAL ELECTRONICS

VISION

To Promote quality education in Medical Electronics Engineering for health and well-being of humankind through teaching and research platforms

MISSION

- To impart knowledge and skills necessary for professional development of graduates in Medical Electronics Engineering.
- To provide continuous up gradation of technical education with strong academic progression.
- To propagate creativity, responsibility, commitment and leadership qualities and exhibit professional ethics and values.

Program Educational Objectives

PEO1: Graduates of Medical Electronics will build career in healthcare and allied fields.

PEO2: Graduates will adapt to the state of art technologies through lifelong learning, will effectively communicate and work a team.

PEO3: Graduates will pursue higher studies and research.

Program Outcomes

PO1	An ability to apply knowledge of mathematics, science and engineering fundamentals for appropriate solutions to Medical electronics.
PO2	An ability to identify, analyze a problem, and formulate the computing requirements appropriate to its solution.
PO3	An ability to design, implement and evaluate an electronic/computer-based system, process to meet desired needs in healthcare.
PO4	An ability to design experiments, as well as to analyze and Interpret Medical data.
PO5	An ability to use current techniques and modern tools necessary for computing practice leading to improvised health care.
PO6	An ability to understand health and safety issues through medical electronics concepts.
PO7	An ability to understand environmental considerations and sustainable engineering solutions in Medical Electronics.
PO8	An ability to understand professional ethics and legal issues related to healthcare technologies.
PO9	An ability to function effectively as an individual and a member in diverse team.
PO10	An ability to communicate effectively with a range of audiences.
PO11	An ability to understand management principles and apply these to manage projects and finance.
PO12	An ability to engage in continuing professional development for lifelong learning.



BMS COLLEGE OF ENGINEERING, BANGALORE-19
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Program: Electrical Cluster (EE/EC/TC/ML/IT) Semester: III

Course Code		Course Title						Hours/Week			Credits	CIE	SEE	Total
								L	T	P				
11	MA31	C	M	A	T		3	2	0	4	50	50	100	
10	ES31	C	N	A	L		4	0	0	4	50	50	100	
11	ES31	C	A	E	C		4	0	2	5	50	50	100	
11	ES31	C	D	E	C		4	0	2	5	50	50	100	
				S	A	S								
11	ES31	C	A	S	P		4	0	0	4	50	50	100	
				M	D	S								
10	ES31	C	E	I	M		3	0	0	3	50	50	100	
09				M	S	T								
Total							22	2	4	25	300	300	600	

GE- Group Elective **L** – Lecture Hours / week; **T**- Tutorial Lecture Hours / week; **P**-Practical Lecture Hours / week.
CIE- Continuous Internal Evaluation; **SEE-** Semester End Examination (of 3 Hours duration)



BMS COLLEGE OF ENGINEERING, BANGALORE-19
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Program: Electrical Cluster (EE/EC/TC/ML/IT) Semester: IV

Course Code		Course Title										Hours/Week			Credits	CIE	SEE	Total
												L	T	P				
11	MA41CAT	Engineering Mathematics-IV										3	2	0	4	50	50	100
11	ES4GLIC	Op-amps and Linear ICs										4	0	2	5	50	50	100
11	ES4GCMCS	Microcontrollers										3	0	2	4	50	50	100
11	ES4GCFTHS	Field Theory (EC/EE/IT/TC)										4	0	0	4	50	50	100
		Signals & Systems (ML)																
09	ES4GCST	Control Systems										4	0	0	4	50	50	100
09	ES4GHDLC	Fundamentals of HDL (EC/TC/ML/IT)										3	0	2	4	50	50	100
		Transformers and Induction Machines (EE)																
11	EA4EDIM																	
Total											21	2	6	25	300	300	600	

GE- Group Elective **L** – Lecture Hours / week; **T**- Tutorial Lecture Hours / week; **P**-Practical Lecture Hours / week.
CIE- Continuous Internal Evaluation; **SEE-** Semester End Examination (of 3 Hours duration)



BMS COLLEGE OF ENGINEERING, BANGALORE-19
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Cluster: Electrical Cluster (EE/EC/TC/ML/IT)

Semester: V

		Course Code										Course Title	Hours/week			Credits	CIE	SEE	Total												
		1	2	M	L	5	D	C	B	M	R		L	T	P																
														4	0	0	4	50	50	100											
														4	0	2	5	50	50	100											
														3	0	0	3	50	50	100											
														4	0	2	5	50	50	100											
														3	0	2	4	50	50	100											
														4	0	0	4	50	50	100											
														22	0	6	25	300	300	600											
Total																															

GE- Group Elective **L** – Lecture Hours / week; **T**- Tutorial Lecture Hours / week; **P**-Practical Lecture Hours / week.
CIE- Continuous Internal Evaluation; **SEE-** Semester End Examination (of 3 Hours duration)



BMS COLLEGE OF ENGINEERING, BANGALORE-19
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Cluster: Electrical Cluster (EE/EC/TC/ML/IT)

Semester: VI

		Course Code							Course Title	Hours/week			Credits	CIE	SEE	Total	
										L	T	P					
1	0	M	L	6	D	C	B	S	P	Biomedical Digital Signal Processing	3	0	2	4	50	50	100
1	2	M	L	6	D	C	C	N	S	Communication Systems	3	0	2	4	50	50	100
1	0	M	L	6	D	C	D	I	P	Digital Image Processing	4	0	2	5	50	50	100
1	2	M	L	6	D	C	B	M	E	Biomedical Equipment	3	0	2	4	50	50	100
1	0	M	L	6	G	E	X	X	X	Elective-II	4	0	0	4	50	50	100
1	0	M	L	6	G	E	X	X	X	Elective-III	4	0	0	4	50	50	100
Total											21	0	8	25	300	300	600

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CIE- Continuous Internal Evaluation; **SEE-** Semester End Examination (of 3 Hours duration)



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Cluster: Electrical Cluster (EE/EC/TC/ML/IT) Semester: VII

		Course Code										Course Title	Hours/week			Credits	CIE	SEE	Total
		1	2	M	L	7	D	C	C	C	N		L	T	P				
		1	2	M	L	7	D	C <td>C<td>C<td>N</td><td>Computer Communication Networks</td><td>4</td><td>0</td><td>2</td><td>5</td><td>50</td><td>50</td><td>100</td> </td></td>	C <td>C<td>N</td><td>Computer Communication Networks</td><td>4</td><td>0</td><td>2</td><td>5</td><td>50</td><td>50</td><td>100</td> </td>	C <td>N</td> <td>Computer Communication Networks</td> <td>4</td> <td>0</td> <td>2</td> <td>5</td> <td>50</td> <td>50</td> <td>100</td>	N	Computer Communication Networks	4	0	2	5	50	50	100
		1	1	M	L	7	D	C <td>L</td> <td>N</td> <td>A</td> <td>Linear Algebra</td> <td>4</td> <td>0</td> <td>2</td> <td>5</td> <td>50</td> <td>50</td> <td>100</td>	L	N	A	Linear Algebra	4	0	2	5	50	50	100
		1	0	M	L	7	G	E <td>X</td> <td>X</td> <td>X</td> <td>Elective-IV</td> <td>4</td> <td>0</td> <td>0</td> <td>4</td> <td>50</td> <td>50</td> <td>100</td>	X	X	X	Elective-IV	4	0	0	4	50	50	100
		1	0	M	L	7	G	E <td>X</td> <td>X</td> <td>X</td> <td>Elective-V</td> <td>4</td> <td>0</td> <td>0</td> <td>4</td> <td>50</td> <td>50</td> <td>100</td>	X	X	X	Elective-V	4	0	0	4	50	50	100
		1	1	M	L	7	I	E <td>1</td> <td>X</td> <td>X</td> <td>Institutional Elective-I</td> <td>4</td> <td>0</td> <td>0</td> <td>4</td> <td>50</td> <td>50</td> <td>100</td>	1	X	X	Institutional Elective-I	4	0	0	4	50	50	100
		1	1	M	L	7	D	C <td>P</td> <td>R</td> <td>J</td> <td>Project Work-I</td> <td>0</td> <td>0</td> <td>4</td> <td>4</td> <td>50</td> <td>50</td> <td>100</td>	P	R	J	Project Work-I	0	0	4	4	50	50	100
												Total	20	0	8	26	300	300	600

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Program: Electrical Cluster (EE/EC/TC/ML/IT) Semester: VIII

Course Code		Course Title		Hours/week			Credits	CIE	SEE	Total
				L	T	P				
11HS8GCI	PR	Intellectual Property Rights	2	0	0	2	50	50	100	
11HS8GCP	RM	Project Management	2	0	0	2	50	50	100	
11ML8IEIX	XR	Institutional/ Elective-II	4	0	0	4	50	50	100	
11ML8DCPR	JR	Project Work-II	0	0	21	14	200	100	300	
11ML8DCSM	RR	Seminar	0	2	0	2	50	50	100	
Total			8	2	21	24	400	300	700	

GE- Group Elective **L** – Lecture Hours / week; **T**- Tutorial Lecture Hours / week; **P**-Practical Lecture Hours / week.
CIE- Continuous Internal Evaluation; **SEE-** Semester End Examination (of 3 Hours duration)



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Group I Electrical Cluster Electives (Programs: EC/TC/IT/EE/ML) Semester: V

Course Code		Course Title	Hours/Week			Credits	CIE	SEE	Total
			L	T	P				
10E	S5GE10P	Object oriented programming using C++	4	0	0	4	50	50	100
12E	S5GE1DD	Digital System Design using VHDL (Except EE)	3	0	2	4	50	50	100
12E	S5GE1IT	Essentials of Information Technology	3	0	2	4	50	50	100
12E	EC5GE1DC	Digital Control of Dynamic Systems (Except IT)	4	0	0	4	50	50	100
12M	L5GE1MP	Medical Physics	4	0	0	4	50	50	100
12M	L5GE1DS	Data Structures with C++ (Except ML)	3	0	2	4	50	50	100
12E	E5GE1CS	Communication Systems (EE only)	4	0	0	4	50	50	100
12E	E5GE1HD	Fundamentals of HDL (EE only)	3	0	2	4	50	50	100



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Semester: VI

Group II Electrical Cluster Electives (Programs: EC/TC/IT/EE/ML)

Course Code							CourseTitle	Hours/Week			Credits	CIE	SEE	Total			
								L	T	P							
1	0	E	E	6	G	E	2	F	V	Fundamentals of VLSI (EE only)	4	0	0	4	50	50	100
1	0	E	E	6	G	E	2	U	P	Utilization of Electrical Power	4	0	0	4	50	50	100
1	2	E	S	6	G	E	2	O	S	Operating Systems Concepts	4	0	0	4	50	50	100
1	2	E	S	6	G	E	2	M	C	Advanced Microcontroller and Applications	3	0	1	4	50	50	100
1	0	T	C	6	G	E	2	S	A	Introduction to Speech and Audio Processing	3	0	1	4	50	50	100
1	2	T	C	6	G	E	2	C	J	Object oriented programming using C++ & Java (Not for those who have taken 12ES5GEIOP)	4	0	0	4	50	50	100
1	0	M	L	6	G	E	2	S	N	Bio Sensors	4	0	0	4	50	50	100
1	2	M	L	6	G	E	2	B	S	Bio Statistics	4	0	0	4	50	50	100
1	0	I	T	6	G	E	2	M	D	Biomedical DSP (Except ML)	3	0	1	4	50	50	100
1	2	I	T	6	G	E	2	M	T	MEMS	4	0	0	4	50	50	100



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Group III Electrical Cluster Electives (Programs: EC/TC/IT/EE/ML)

Semester: VI

Course Code							CourseTitle	Hours/Week				Credits	CIE	SEE	Total	
								L	T	P						
1	2	E	E	6	G	E	D	Embedded System Design	4	0	0		4	50	50	100
1	2	E	E	6	G	E	D	Electronic Instrumentation (EE only)	4	0	0		4	50	50	100
1	0	E	E	6	G	E	R	Renewable Energy Resources	4	0	0		4	50	50	100
1	0	E	E	6	G	E	R	Real Time Embedded Systems	4	0	0		4	50	50	100
1	0	T	C	6	G	E	A	Automotive Embedded Systems Development Technology	4	0	0		4	50	50	100
1	2	E	S	6	G	E	I	Fundamentals of Image processing (Except ML)	4	0	0		4	50	50	100
1	0	T	C	6	G	E	M	Design of Analog and Mixed mode VLSI circuits (Only TC)	4	0	0		4	50	50	100
1	2	M	L	6	G	E	B	Biomedical circuits with VLSI	4	0	0		4	50	50	100
1	0	M	L	6	G	E	R	Rehabilitation Engineering	4	0	0		4	50	50	100
1	0	I	T	6	G	E	R	Robotics	4	0	0		4	50	50	100
1	2	I	T	6	G	E	O	Optical Instrumentation I	4	0	0		4	50	50	100



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Semester: VII

Group IV Electrical Cluster Electives (Programs: EC/TC/IT/EE/ML)

Course Code						CourseTitle	Hours/Week			Credits	CIE	SEE	Total			
							L	T	P							
1	1	E	E	7	G	E	4	S	Power Systems Operation and Control	4	0	0	4	50	50	100
1	1	E	E	7	G	E	4	I	Industrial Drives and Applications	4	0	0	4	50	50	100
1	2	T	C	7	G	E	4	M	Low power Microcontroller (Except ML)	3	0	1	4	50	50	100
1	1	T	C	7	G	E	4	S	Software Defined Radio (only EC, TC)	4	0	0	4	50	50	100
1	2	E	S	7	G	E	4	M	Multimedia Concepts	4	0	0	4	50	50	100
1	2	M	L	7	G	E	4	B	Biometrics	4	0	0	4	50	50	100
1	2	M	L	7	G	E	4	A	Introduction to Audio & Video processing	4	0	0	4	50	50	100
1	1	E	C	7	G	E	4	W	Wireless communication (Except TC)	4	0	0	4	50	50	100
1	1	E	C	7	G	E	4	S	Embedded Systems Design	4	0	0	4	50	50	100
1	1	I	T	7	G	E	4	D	Distributed Computing	4	0	0	4	50	50	100
1	1	I	T	7	G	E	4	M	Medical Imaging Systems (Except ML)	4	0	0	4	50	50	100



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Semester: VII

Group V Electrical Cluster Electives (Programs: EC/TC/IT/EE/ML)

Course Code		CourseTitle	Hours/Week			Credits	CIE	SEE	Total
			L	T	P				
1 2	E 7 G E 5 P Q	Electrical Power Quality	4	0	0	4	50	50	100
1 1	E 7 G E 5 S P	Switch Mode Power Supplies	4	0	0	4	50	50	100
1 1	T C 7 G E 5 E M	EMC -EMI	4	0	0	4	50	50	100
1 1	T C 7 G E 5 S C	Satellite Communication	4	0	0	4	50	50	100
1 1	E S 7 G E 5 A D	ASIC Design	4	0	0	4	50	50	100
1 1	M L 7 G E 5 I P	Advanced Medical Image Processing	4	0	0	4	50	50	100
1 1	M L 7 G E 5 S P	Advanced Biomedical Digital Signal Processing	4	0	0	4	50	50	100
1 1	E S 7 G E 5 N S	Network Security	4	0	0	4	50	50	100
1 1	E C 7 G E 5 L P	Low Power VLSI design	4	0	0	4	50	50	100
1 1	I T 7 G E 5 E S	Embedded System and RTOS	4	0	0	4	50	50	100
1 1	I T 7 G E 5 C N	Computer Communication Networks (Except TC & EC)	4	0	0	4	50	50	100



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III SEMESTER

MEDICAL ELECTRONICS

Subject Title	ENGINEERING MATHEMATICS – III	Credits	4
Sub.Code	11MA3ICMAT	L-T-P	3-1-0

Course Outcomes

Co1: Express given functions to form Fourier series.

Co2: Demonstrate an understanding of Fourier transforms techniques.

Co3: Employ analytical techniques to solve partial differential equations with appropriate boundary conditions.

Co4: Compute interpolating polynomials, derivatives, integrals for a given function from a given data.

Co5: Apply Z- transforms techniques to solve difference equations.

UNIT I

[09 hours]

FOURIER SERIES

Infinite series, convergence and divergence of infinite series of positive terms, power series, periodic function, Dirichlet's conditions, statement of Fourier Theorem, Fourier series of periodic function of period 2 and arbitrary period, half range Fourier series, practical harmonic analysis.

[7 L + 2 T]

UNIT II

[9 hours]

FOURIER TRANSFORMS

Infinite Fourier transform, Fourier Sine and Cosine transforms, properties, Inverse transforms, Convolution theorem (statement only), Parseval's identities for Fourier transform. Fourier transforms of the derivatives of a function

[7 L + 2 T]



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UNIT III

[12 hours]

PARTIAL DIFFERENTIAL EQUATIONS

Formation of Partial differential equations-elimination of arbitrary constants, elimination of arbitrary functions. Equations of first order- The linear equation $P p + Q q = R$ (Lagrange's partial differential equation). Method of separation of variables. **[5L+2T]**

PARTIAL DIFFERENTIAL EQUATIONS

Formation of Partial differential equations-elimination of arbitrary constants, elimination of arbitrary functions. Equations of first order- The linear equation $P p + Q q = R$ (Lagrange's partial differential equation). Method of separation of variables. **[5L+2T]**

APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

One-dimensional heat equation and wave equation (without proof), various possible solutions of these by the method of separation of variables, D'Alembert's solution of wave equation. **[4L+1T]**

UNIT IV

[11 hours]

NUMERICAL METHODS Finite Differences and interpolation: Forward differences, Backward differences. Interpolation: Newton-Gregory forward interpolation formula, Newton-Gregory backward interpolation formula, Lagrange's interpolation formula, Lagrange's inverse interpolation. Numerical differentiation: Numerical differentiation using Newton-Gregory forward and backward interpolation formula. **[4L+2T]**

Numerical integration: Trapezoidal rule, Simpson's $1/3^{\text{rd}}$ rule, Simpson's $3/8^{\text{th}}$ rule, Weddle's rule. Solution of algebraic and transcendental equations: Newton-Raphson method, Numerical solution of ordinary differential equations: Euler's modified method, Runge-Kutta method of fourth order. **[4L+1T]**

UNIT V

[11 hours]

Z -TRANSFORMS

Definition, Properties, Transforms of standard functions, Inverse transforms.

APPLICATIONS OF Z-TRANSFORMS

Solution of difference equations using Z- transforms. **[5L+1T]**



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CALCULUS OF VARIATIONS

Variation of function and functional, Euler's equation, variational problem.

APPLICATIONS OF CALCULUS OF VARIATIONS

Geodesics of a right circular cylinder, minimal surface of revolution, hanging chain, Brachistochrone problem. **[4L+1T]**

TEXT BOOKS:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 8th edition, 2007, Wiley-India
2. Higher Engineering Mathematics, B.S. Grewal, 40th edition, 2007, Khanna Publishers.
3. Introductory methods of Numerical Analysis, S. S. Sastry, 3rd edition, 1999, Prentice-Hall of India.

REFERENCE BOOKS:

1. Advanced Modern Engineering Mathematics, Glyn James, 3rd edition, 2004, Pearson Education.
2. Higher Engineering Mathematics, B.V. Ramana, 2007, Tata Mc. Graw Hill.
3. Advanced Engineering Mathematics, P. V. O'Neil, 5th Indian reprint, 2009, Cengage learning India Pvt. Ltd.
4. Advanced Engineering Mathematics, 3rd edition by Dennis G. Zill and Cullen, Jones and Bartlett India Pvt. Ltd..

Question Paper Pattern

1. Each unit consists of one full question with or without internal choice.
2. Internal choice may be there in maximum of two units.
3. Each full question consists of three or four subdivisions covering the entire syllabus of the Unit
4. One question to be answered in each Unit.



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Subject Title	NETWORK ANALYSIS	Credits	4
Sub.Code	10ES3GCNAL	L-T-P	4-0-0

Course Outcomes

- CO1: Apply KCL, KVL and network topology to solve AC and DC Networks
- Co2: Identify and apply suitable technique for network reduction and simplification.
- Co3: Understand various network theorems.
- Co4: Analyze the behavior of circuit elements under different switching conditions.
- Co5: Apply knowledge of Laplace transforms for two- port network parameters and state variables..

UNIT I

[08 hours]

Basic Concepts:

Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh.

UNIT II

[10 hours]

Network Topology: Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set, tie-set & cut-set schedules, Formulation of equilibrium equations, Principle of duality.

Resonant Circuits: Series and parallel resonance, frequency response of series and Parallel circuits, Q –factor, Bandwidth

UNIT III

[12 hours]

Network Theorems :

Superposition, Reciprocity, Millman's, Thevinin's and Norton's theorems; Maximum Power transfer theorem



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UNIT IV

[12 hours]

Transient behavior and initial conditions:

Behavior of circuit elements under switching condition and their representation, evaluation of initial and final conditions in RL, RC and RLC circuits

Laplace Transformation & Applications

Review of Laplace transforms, waveform Synthesis, initial and final value theorems, step, ramp and impulse responses, convolution theorem, solution of simple R-L, R-C, R-L-C networks for AC and DC excitations using Laplace transforms.

UNIT V

[10hours]

Two port network parameters:

Definition of z , y , h and transmission parameters, modeling with these parameters, relationship between parameters sets.

TEXT BOOKS:

1. **"Network Analysis"**, M. E. Van Valkenburg, PHI / Pearson Education, 3rd Edition. Reprint 2002.
2. **"Networks and systems"**, Roy Choudhury, 2nd edition, 2006 re-print, New Age International Publications.
3. **Theory and Problems of Electric Circuits** (Schaum Series), 2nd Edition Mc Graw Hill

REFERENCE BOOKS:

1. **"Engineering Circuit Analysis"**, Hayt, Kemmerly and Durbin, TMH 6th Edition, 2002
2. **"Network analysis and Synthesis"**, Franklin F. Kuo, Wiley
3. **"Analysis of Linear Systems"**, David K. Cheng, Narosa Publishing House, 11th reprint, 2002
4. **"Circuits"**, Bruce Carlson, Thomson Learning, 2000. Reprint 2002



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Subject Title	ANALOG ELECTRONIC CIRCUITS	Credits	5
Sub.Code	11ES3GCAEC	L-T-P	4-0-1

Course Outcomes

- Co1: Understand the basic working principle and Applications of Diode.
- Co2: Learn Biasing concepts of Bipolar Junction Transistors.
- Co3: Understand frequency response of BJT's which will help in Designing of Amplifiers.
- Co4: Learn the concepts of Feedback types and Power Amplifier Classifications which will help in designing power Amplifiers.
- CO5: Understand construction and Biasing of Field Effect Transistors.

UNIT I

[10 hours]

Semiconductor Diodes – Semiconductor diode, ideal versus practical, resistance levels, diode equivalent circuits, transition and diffusion capacitance, reverse recovery time, diode specification sheets, semiconductor diode notation, diode testing.

Diode Applications – Introduction, load – line analysis, series diode configurations, parallel and series –parallel configurations, clippers, clampers, voltage multipliers.

UNIT II

[12 hours]

DC biasing of BJTS – Introduction, operating point, fixed bias circuit, emitter bias, voltage divider bias, dc bias with voltage feedback, miscellaneous bias configurations, design operations, transistor switching networks, troubleshooting techniques, PNP transistors, bias stabilization.

BJT AC Analysis – Introduction, amplification in the ac domain, BJT transistor modeling, r_e transistor model, the hybrid equivalent model, CE fixed bias, voltage divider bias, CE emitter bias, Determining the current gain, Effect of R_L and R_s , two-port system approach, summary tables, complete hybrid equivalent model, problems on h parameters(only CE configuration)



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UNIT III

[10 hours]

Cascaded systems, Darlington connections, BJT frequency response – Introduction, logarithms, decibels, general frequency considerations, low frequency analysis – bode plot, BJT low frequency response, miller effect capacitance, BJT high frequency response

UNIT IV

[10 hours]

Feedback Circuits (BJT version only)– Feedback concepts, feedback connection types, practical feedback circuits,

Power amplifiers – Introduction – definitions and amplifier types, series fed class A amplifier, transformer coupled class A amplifier, class B amplifier operation, class B amplifier circuits. Amplifier distortion, Power transistor heat sink, class C and class D amplifiers.

UNIT V

[10 hours]

FETs– Introduction, construction and characteristics of JFETs, transfer characteristics, important relationships, JFET small signal model, JFET fixed bias, self bias, voltage divider configuration, JFET source follower, Depletion and Enhancement type MOSFETS. UJT principle and characteristics

LAB Experiments: – Clipping, clamping, Bridge rectifiers, RC coupled amplifiers, Darlington emitter follower, RC phase shift & crystal oscillator, voltage series feedback amplifier, JFET static characteristics, UJT relaxation oscillator, Simulation experiments using Multisim/P-Spice

TEXT BOOK:

Electronic Devices and Circuit Theory- Boylestad and Louis Nashelsky, 9th edition
- Pearson

REFERENCE BOOKS:

1. **Electronic Devices and Circuits-** Millman and Halkias, TMH
2. **Electronic Devices and Circuits-** David A Bell - PHI 4th edition



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Subject Title	DIGITAL ELECTRONICS	Credits	5
Sub.Code	11ES3GCDEC	L-T-P	4-0-1

Course Outcomes

- Co1: Learn simplifications of Boolean expressions using K-maps and tabulation method.
- Co2: Analyze the designing process of combinational circuits
- Co3: Understand working of Flip-flops, registers and design, analyze the sequential Circuits

UNIT I

[11 hours]

Introduction :Review of Boolean algebra, logic gates.

Simplification of Boolean functions : The Map Method, Two and Three Variable Maps, Four Variable Map, Five and Six variable Maps, Product of sums simplification, NAND and NOR implementation, Other Two level implementations, Don't care conditions, The Tabulation Method, Determination of Prime Implicants, Selection of prime implicants , Concluding Remarks \

UNIT II

[11 hours]

Combinational Logic Circuits: Introduction, Design Procedure, Adders, Subtractors, Code conversion

Combinational Logic with MSI and LSI:

Introduction, Binary Parallel Adder, Decimal Adder, Magnitude Comparator, Decoders, Multiplexers, Programmable Logic Devices, Programmable Read Only memories (PROMs), Programmable Logic Arrays(PLAs), Programmable array logic (PAL)

UNIT III

[10 hours]

Flip-Flops and Simple Flip –Flops Applications:

The Basic Bistable Element, Latches, Timing Considerations, Master Slave Flip-Flops(pulse-Triggered Flip-flops), Edge Triggered Flip Flops, Characteristic Equations



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UNIT IV

[09 hours]

Sequential Logic Circuits:

Registers, Counters, Design of Synchronous Counters

UNIT V

[11hours]

Synchronous Sequential circuits:

Structure and Operation of Clocked Synchronous sequential Networks, Analysis of clocked synchronous sequential networks, Modeling clocked synchronous sequential network behavior, state table reduction, The state assignment, Completing the design of clocked synchronous sequential networks.

LAB experiments: – Verification of gates, implementation using basic gates and universal gates, Code conversion (Binary to gray, BCD to Excess 3), verify adders, subtractors, multiplexers, demultiplexers, comparators & code converter, verification of Flip-flops, counters, shift registers

TEXT BOOKS:

1. **Digital logic and computer design**- Morris Mano, Prentice Hall
2. **Digital Principles and Design**- Donald Givone, Tata McGraw Hill

REFERENCE BOOKS:

1. **Fundamental of Logic Design**- Charles Roth Jr., Thomas Learning
2. **Digital Logic Applications and principles**- John Yarbrough, **Pearson Education**



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Subject Title	MEDICAL SCIENCE(ML Only)	Credits	4
Sub.Code	11ES3GCMDS	L-T-P	4-0-0

Course Outcomes

- Co1: Understand basics of Tissues, cartilage, propagation of action potential and Nervous system
- Co2: Understand the anatomy and physiology of cardiovascular system.
- Co3: Learn the anatomy and physiology of Digestive system.
- Co4: Understand basics of anatomy and physiology of Respiratory System, Endocrine system, Urinary and reproductive system.
- Co5: Understand the structure and function of skeletal systems, Muscles and joints

UNIT1

[10 Hours]

Introduction: Homeostasis, Tissue, Cartilage: The internal environment and homeostasis, movement of substances within the body, body fluids, action potential, propagation of action potential. Epithelial tissue- simple epithelium, stratified epithelium, connective tissue- cells of connective tissue, loose connective tissue, Adipose tissue, Dense connective tissue, Lymphoid tissue, Cartilage- Hyaline cartilage, Fibrocartilage, Elastic cartilage.

Nervous System: Neurons: Properties of neurons, Cell bodies, Axon and Dendrites, Types of nerves, Synapse and neurotransmitters, neuromuscular junction. Central nervous system: neuroglia, meninges, ventricles of the brain and CSF. Brain: Cerebrum, functions of cerebrum, functional areas of the cerebrum. Brainstem: Cerebellum, Spinal cord- grey matter, white matter, motor nerve tracts, spinal nerves: nerve roots, plexuses, cranial nerves. Autonomic nervous system (in brief)- functions and effects.

UNIT2

[10Hours]

Cardiovascular System: Introduction, Blood vessels- Arteries and Arterioles, Veins and Venules, capillaries and sinusoids, control of blood vessel diameter, blood supply- internal respiration, cell nutrition. Heart position, structure- pericardium, myocardium, endocardium, interior of the heart, flow of blood through the heart, blood supply to heart,



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Conducting system of the heart, factors affecting heart rate, the Cardiac cycle, cardiac output, blood pressure, control of blood pressure, pulse and factors affecting the pulse rate. Circulation of the blood- pulmonary circulation, systemic circulation, aorta, circulation of blood to head and neck, circulation of blood to upper limb, portal circulation.

UNIT3

[10 Hours]

Digestive System: Introduction, Organs of the digestive system- mouth: tongue, teeth, salivary glands, pharynx, oesophagus, stomach, gastric juice and functions of stomach- small intestine: structure, chemical digestion in small intestine, large intestine: structure, functions of the large intestine, rectum and anal canal. Pancreas, Liver.

UNIT4

[12 Hours]

Respiratory System: Introduction, Nose and Nasal cavity- position, structure and functions, pharynx, position, structure, functions. Larynx: position, structure and functions. Trachea, bronchi, bronchioles and alveoli, lungs- position, associated structure, pleura and pleural cavity. Respiration muscles of respiration cycle of respiration, variables affecting respiration, lung volumes and capacity.

Endocrine, Urinary and Reproductive System: Pituitary gland, thyroid gland, parathyroid gland, adrenal gland. Parts of urinary system, kidneys organs associated with the kidneys, gross and microscopic structure of the kidney, functions of the kidneys, ureter, urinary bladder, urethra, micturition.

UNIT5

[10 Hours]

Skeletal System: Bone, Types of bone, structure, bone cells, functions of bone. Axial skeleton- skull, sinuses, Fontanelles, vertebral column characteristics of typical vertebra, different parts of vertebral column (parts only), features of vertebral column, movements and functions of vertebral column, sternum, ribs, shoulder girdle and upper limb, pelvic girdle and lower limb.

Muscles and Joints (Study of muscles along with joints): Muscle tissue: Skeletal muscle, Smooth muscle, Cardiac muscle, functions of muscle tissue, muscle tone and fatigue. Types of joint- Fibrous, Cartilaginous, Synovial, characteristics of synovial joints, shoulder joint, elbow joint, radioulnar joint, wrist joint, joints of hands and fingers, Hip joint, Knee joint, ankle joint, joints of foot and toes.



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Textbook:

1. Ross & Wilson's Anatomy and Physiology in Health and Illness – by Anne Waugh and Allison Grant, 9th Edition, Churchill Livingstone Publications.

Reference Books:

1. Concise Medical Physiology- by Sujit K. Chaudhuri, 5th Edition, New Central Book Agency Pvt. Ltd.
2. Essentials of Medical Physiology - by K. Sembulingam and PremaSembulingam, 3rd Edition, Jaypee Publications.
3. Human Physiology: From Cells to Systems - by Lauralee Sherwood, 6th Edition, Brooks Cole Publication.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	MEASUREMENT TECHNIQUES (EE/IT/ML)	Credits	3
Sub.Code	09ES3GCMST	L-T-P	3-0-0

Course Outcomes

- Co1: Understand various instruments and their functioning.
- CO2: Learn the design of different bridges.
- Co3: Understand design of electrical & electronics measuring instruments.
- CO4: Learn the classification and performance characteristics of Transducers
- Co5: Learn the basics of Display devices and Recorders.

UNIT I

[07 hours]

Fundamentals of Measurement

Introduction, Static Characteristics, Dynamic Characteristics, Errors in measurement, Types of errors, Sources of error. *Electrical Measuring Instruments*: Types of Instruments, Principle of Operation, Constructional features of PMMC instrument, shunts & multipliers, universal shunt, multi range voltmeters.

UNIT II

[08 hours]

Electronic Measuring Instruments:

Need for electronic measuring instruments, True RMS responding voltmeter, Digital voltmeters- Ramp Type, Integrating Type, Successive Approximation Type, Q meter, Digital Multimeter - Block Diagram description.

UNIT III

[08 hours]

Measurement of Resistance, Inductance & Capacitance:

Wheatstone's Bridge- Sensitivity analysis, Limitations, Kelvin's Double Bridge, Maxwells Bridge, Schering Bridge, sources & Detectors, Minimization of AC Bridge Errors, Problems.



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UNIT IV

[08 hours]

Transducers -I:

Classification & Selection, Principle of operation of Thermocouples, Resistance Temperature Detectors, Thermistors, LVDT, Capacitive Transducers, Piezoelectric Transducers.

UNIT V

[08 hours]

Transducers -II:

Strain Gauges- Types, Expression for gauge factor, Photosensitive Devices. Display Devices & Recorders : Method of Measuring Amplitude, Phase, Frequency & Period using CRO. Use of Lissajous Patterns. LCD & LED displays, Strip Chart & X-Y Recorders. Introduction to Printers.

TEXT BOOKS:

1. Modern Electronic Instrumentation & Measurement Technique- Albert D. Helfrick, William D. Cooper, 3/e, Pearson, Prentice Hall .
2. Electronic Instrumentation- H. S. Kalsi, Tata McGraw Hill.

REFERENCE BOOKS:

1. A Course in Electrical & Electronic Measurements & Instrumentation- A. K. Sawhney, 18/e, Dhanpat Rai & Co., New Delhi.
2. Electronic Instrumentation & Measurement- by David A. Bell, 2/e, PHI Publications.



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IV SEMESTER

MEDICAL ELECTRONICS

Subject Title	ENGINEERING MATHEMATICS – IV	Credits	4
Sub.Code	11MA4ICMAT	L-T-P	3-1-0

Course Outcomes

- CO1: Estimate the relation between two variables and perform regression analysis.
- Co2: Apply the basic principles of probability and probability distributions.
- CO3: Compute joint probabilities of two random variables.
- CO 4: Calculate transition probabilities using Markov chain.
- CO5: Construct analytic functions and evaluate real and complex integrals.
- CO 6: Discuss series solution of ordinary differential equations

UNIT I

[10 hours]

STATISTICS

Curve fitting – Fitting a straight line, fitting of a parabola, fitting of curves of the form

$$y = a b^x, y = a x^b, y = a e^{bx}; \text{ Correlation and regression.}$$

Probability of an event, axiomatic definition, addition theorem, conditional probability multiplication theorem, Bayes' theorem

[4L+1T]

UNIT II

[10 hours]

PROBABILITY 2

Probability distributions: Random variables, Discrete probability distributions, continuous probability distributions, Some standard distributions: Binomial distribution, Poisson distribution, exponential distribution, normal distribution.

[8L+2T]

UNIT III

[10 hours]

COMPLEX ANALYSIS 1

Function of a complex variable, Analytic functions, Cauchy-Riemann equations, construction of analytic functions, Cauchy-Reimann equations in Polar form. Transformations- $w = z^2$, $w = e^z$ and $w = \frac{a^2}{z}$ $z \neq 0$ Bilinear transformations.

[8L+2T]



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UNIT IV

[12 hours]

COMPLEX ANALYSIS 2

Complex integration-Cauchy's theorem, Cauchy's integral formula, Taylor's and Laurent's series, Singular points, poles, residues, the residue theorem. **[5L+2T]**

SERIES SOLUTION OF DIFFERENTIAL EQUATIONS

Series solution-Frobenius method, series solution of Bessel's differential equation leading to Bessel function of first kind, equations reducible to Bessel's differential equation, series solution of Legendre's differential equation leading to Legendre polynomials, Rodrigue's formula. **[4L+1T]**

UNIT V

[10 hours]

PROBABILITY 3

Joint Probability distributions: Case of discrete random variables, mathematical expectation, correlation, covariance.

Markov Chain: Probability vectors, stochastic matrices, fixed points, regular stochastic matrices. Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states. **[7L+3T]**

TEXT BOOKS:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 8th edition, Wiley Publications.
2. Higher Engineering Mathematics, B.S. Grewal, 40th edition, Khanna Publishers.

REFERENCE BOOKS:

1. Advanced Modern Engineering Mathematics, Glyn James, 3rd edition, 2004, Pearson Education.
2. Higher Engineering Mathematics, B.V. Ramana, 2007, Tata Mc. Graw Hill
3. Advanced Engineering Mathematics, P. V. O' Neil, 5th Indian reprint, 2009, Cengage learning India Pvt. Ltd.

Question Paper Pattern

1. Each unit consists of one full question with or without internal choice.
2. Internal choice may be there in maximum of two units.
3. Each full question consists of three or four subdivisions covering the entire syllabus of the



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Subject Title	OP-AMPS AND LINEAR ICS	Credits	5
Sub.Code	11ES4GCLIC	L-T-P	4-0-1

Course Outcomes

- CO1: Understand Circuit configurations of Linear ICs and Operational Amplifier Characteristics.
- Co2: Learn linear and non-linear applications of operational amplifiers
- CO3: Understand the Working principle and Design of Active filters and waveform Generators.
- CO4: Understand the working principle of 555timer and learn to design a Monostable and AstableMultivibrator Circuits.
- Co5: Learn specifications and applications of Analog to Digital Converters and Digital to Analog Converters.

UNIT I

[10 hours]

Circuit configurations for linear ICs: Introduction, Current sources- current mirror, basic current source circuit

Differential amplifiers: Differential amplifiers using BJT(DC analysis only), CMRR, Input impedance R_i , output impedance R_o

Operational amplifier characteristics : Introduction, ideal op-amp, practical op-amp, IC 741 bi-polar opamp-bias circuit, input stage, gain stage, output stage, DC performance characteristics of opamp, AC performance characteristics of opamp, slew rate, noise, open-loop configurations, closed loop op-amp configurations, differential amplifiers, general description, power supply connections

UNIT II

[10 hours]

a. Applications of op-amps: Introduction, sign changer, scale changer, phase shift circuits,

voltage followers, voltage controlled voltage source, current sources, inverting current amplifier, current controlled current source, V-to-I , I-to-V converters, adder, subtractor, adder-subtractor, instrumentation amplifier, integrator, differentiator



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b. Op-amp non-linear circuits: Introduction, opamp comparator, zero-cross detector, Schmitt trigger, Precision rectifiers, peak Detectors, sample -and -hold circuit, clippers, clampers

UNIT III

[12 hours]

a. **Active Filters:** Introduction, comparison between passive and active network design, Design of low pass filters, high pass filters, all-pass filters

b. **Waveform generators:** Introduction, sine-wave generators- Weinbridge, RC phase shift, Multivibrators- astable, monostable, triangular waveform generators

UNIT IV

[10 hours]

a. **555 timer:** General description of 555, Monostable operation, Astable Operation,

b. **Voltage regulators:** Introduction, Basics of voltage regulator, linear voltage regulator using op amp- single polarity linear voltage regulator, IC voltage Regulators, IC723 General purpose Regulator. SMPS –Introduction only

UNIT V

[10 hours]

A/D and D/A convertors: Introduction, Analog and digital data conversions, specifications of DAC, basic D/A conversion techniques- weighted resistor DAC, R-2R DAC, A/D converters, specifications of ADC, classification of ADC, different types of ADC

LAB Experiments

Inverting amplifier, non-inverting amplifier, summing amplifier and voltage follower, precision half wave, and full wave rectifier, clipping circuits, clamping circuits, differentiator and integrator, Schmitt trigger and zero crossing detector, Wien bridge oscillator, first order low-pass and high pass filter, IC 723 low voltage and high voltage regulator, A/D and D/A converters.

TEXT BOOKS:

1. Linear Integrated circuits - S.Salivahanan, V S KanchanaBhaaskaran, TMH

REFERENCE BOOK:

1. Op-Amps and Linear Integrated Circuits- Ramakanth A.Gayakwad,4th ed,PHI.
2. Linear Integrated circuits; D.RoyChoudhury and Shail B.Jain,2nd ed, Reprint 2006, New Age International
3. Op-Amps and Linear ICs: David A Bell, 2nd Edition, PHI



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Subject Title	MICROCONTROLLERS	Credits	4
Sub.Code	11ES4GCMCS	L-T-P	3-0-1

Course Outcomes

- Co1: Understand microcontroller architecture.
- Co2: Learn 8051 assembly language programming .
- CO3: Learn embedded "C" Programming.
- CO4: Learn Programming the Timer and serial communication Interrupts.
- CO5: Understand Interfacing 8051 Microcontroller with peripherals.

UNIT I [08 hours]

INTRODUCTION TO MICROCONTROLLERS: Microprocessors and microcontroller, Introduction, Difference between Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture, Embedded Electronic Systems and Microcontrollers, comparison of Different microcontrollers and applications.

The 8051 Architecture: Introduction, 8051 Microcontroller Hardware, Input / Output Pins, Ports and Circuits, External Memory.

UNIT II [08 hours]

ASSEMBLY LANGUAGE PROGRAMMING IN 8051: Addressing Modes and Instruction set: Introduction, Addressing modes, Data transfer instructions, Example Problems, Arithmetic instructions, Logical instructions, Example Problems, JUMP and CALL Program range, Jumps, calls and Subroutines, Returns, Example Problems.

UNIT III [08 hours]

EMBEDDED 'C' PROGRAMMING: 8051 programming in C: Data types and time delays in 8051 C, I/O programming, logic operations, data conversion programs, accessing code ROM space, data serialization.

Timer / Counter Programming in 8051: Counters and timers programming 8051 Timers, Counter Programming, programming timers 0 and 1 in 8051 C.

UNIT IV [08 hours]

8051 Serial Communication: Basics of Serial Communication- Serial data input/output, 8051 connections to RS-232, 8051 Serial communication Programming,



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Interrupts Programming:, 8051 Interrupts, Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Interrupt programming in C

UNIT V

[07 hours]

8051 INTERFACING AND APPLICATIONS:

Interfacing 8051 to LCD, Keyboard, DAC, ADC Stepper motor interfacing.

LABORATORY EXPERIMENTS:

Part A: Data Transfer, Logical-Byte/Bit manipulations, Jump and Subroutine Calls using Assembly language, counters and delay generation using timers, Embedded C programs

Part B: Interfacing: LCD Display, Stepper motor control using interrupt, Elevator interface and 7segment interface, DAC, keyboard.

The Experiments will be implemented using 'Keil' software with Embedded IDE. For interface, 8051 hardware kit is used.

TEXT BOOKS:

1. **"The 8051 Microcontroller Architecture, Programming & Applications"**, Kenneth J. Ayala 2e, Thomson Learning 2005
2. **"The 8051 Microcontroller and Embedded Systems – using assembly and C "**, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D .McKinlay; PHI, 2006

REFERENCE BOOKS:

1. "Programming and Customizing the 8051 Microcontroller", Predko ;, TMH
2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005
3. "PIC Microcontrollers", J.B. Peatman;" PHI, 2006



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	SIGNALS AND SYSTEMS (ML Only)	Credits	4
Sub.Code	11ES4GCSAS	L-T-P	4-0-0

Course Outcomes

- CO1: Understand the classification of signals and systems.
- CO2: Learn the concept of convolution and properties of impulse response
- CO3: Learn the Fourier representation of the signals and their properties.
- CO4: Learn the Fourier transform representations of periodic and discrete time signals.
- Co5: Learn the Z transforms and its properties.

UNIT 1:

Definitions of a signal and a system, Classification of signals, Basic operations on signals, Elementary signals, Systems viewed as interconnection of operations, Properties of systems. **10 Hours**

UNIT 2:

Convolution, Impulse response representation, Convolution sum, Convolution integral, Properties of impulse response, Differential and Difference equations representations, Block diagram representations **12 Hours**

UNIT 3:

Fourier Representation for signals-: Introduction, Discrete time and continuous time Fourier series (derivation of series excluded) and their properties

Fourier Representation for signals-: Discrete and Continuous time Fourier transforms (derivations of transforms are excluded) and their properties. **12 Hours**

UNIT 4:

Applications of Fourier Representations: Introduction, Frequency response of LTI, Fourier transform representation of periodic signals, Fourier transform representation of discrete time signals. **08 hours**



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UNIT 5:

Z-Transforms- Introduction, Z-transform, properties of ROC. Properties of Z transform inversion of Z-transforms.

Z-Transforms-: Transform analysis of LTI Systems, Unilateral Z- Transform and its application to solve difference equations. **10 Hours**

Text Books:

1. Signals and Systems-Simon Haykin and Barry Van Veen, John Wiley & Sons, 2001. Reprint 2001

Reference Books:

1. Signals and Systems: Analysis of signals through linear systems- Michel J Roberts, TMH, 2003.
2. Signals and Systems-Alan V Oppenheim, Alan S Willsky and S.HamidNawab- Pearson Education Asia, 2nd ed 1997, Indian reprint 2002
3. Ganesh Rao and SathishTunga. " Signals and Systems", Sanguine Technical Publishers,2004
4. H.P. Hsu, R. Ranjan," Signals and Systems",Scham'soutlines,TMH 2006
5. B.P.Lathi "Linear Systems and Signals.", Oxford University Press,2005



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	CONTROL SYSTEMS	Credits	4
Sub.Code	09ES4GCCST	L-T-P	4-0-0

Course Outcomes

- CO1: Apply KVL and KCL for mathematical modeling of linear systems.
- CO2: Understand Time response analysis of control systems for first order and Second order systems.
- CO3: Learn different methods of Stability analysis.
- CO4: Learn stability analysis techniques in the design of systems.
- Co5: Learn frequency response analysis.

UNIT I

[12 hours]

Introduction: Examples of Control Systems, open loop vs Closed loop Systems, Classifications of Control Systems.

Mathematical Modeling of Linear Systems: Transfer functions, Mechanical Systems, Analogous Systems, Block diagram, Signal Flow graph (excluding gear trains lever)

UNIT II

[10 hours]

Time response analysis of Control Systems : Step response of first order, second order systems, response specification , steady state error and error constants.

UNIT III

[10 hours]

Stability Analysis: Concept of stability, RH criterion, applications of RH criterion with limitations, Nyquist plot, Polar plots, Stability Analysis using Nyquist criterion

UNIT IV

[10 hours]

Root locus technique: Introduction to root locus concepts, Construction rules, Analysis of stability by root locus plot.



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UNIT V

[10 hours]

Frequency response Analysis: Bode plots, Relative stability, Frequency domain specification.

TEXT BOOK:

Control Engineering by Nagrath&Gopal, New Age International Publishers

REFERENCE BOOKS:

- 1. Modern control Engineering-** Ogata, Prentice Hall
- 2. Automatic Control Systems-** B.C Kuo, John Wiley and Sons



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Subject Title	FUNDAMENTALS OF HDL (EC/TC/ML/IT)	Credits	4
Sub.Code	09ES4GCHDL	L-T-P	3-0-1

Course Outcomes

- CO1: Understand the history and classification of HDL.
- CO2: Learn the different description styles and their structure.
- Co3: Understand the data types and operators.
- CO4: Understand the importance of procedures, tasks and functions.
- CO5: Learn the synthesis and mapping in the hardware domain.

UNIT I

[07 hours]

Introduction: Why HDL? , A Brief History of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, simulation and synthesis, Brief comparison of VHDL and Verilog

UNIT II

[08 hours]

Data-Flow Descriptions: Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type – Vectors. **Behavioral Descriptions:** Behavioral Description highlights, structure of HDL behavioral Description, The VHDL variable –Assignment Statement, sequential statements.

UNIT III

[08 hours]

Structural Descriptions: Highlights of structural Description, Organization of the structural Descriptions, Binding, state Machines, Generate, Generic, and Parameter statements.

UNIT IV

[08 hours]

Procedures and Functions: Procedures, Tasks, and Functions: Highlights of Procedures, tasks, and Functions, Procedures and tasks, Functions. **Advanced HDL Descriptions:** File Processing, Examples of File Processing.



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UNIT V

[08 hours]

Synthesis Basics: Highlights of Synthesis, Synthesis information from Entity and Module, Mapping Process and Always in the Hardware Domain.

LAB Experiments

Combinational logic circuits, sequential circuits using data flow (simulation and implementing using FPGA/CPLD) sequential descriptions & structural descriptions. Interfacing experiments : stepper motor, dc motor, relay, waveform generation.

TEXT BOOK:

HDL Programming (VHDL and Verilog)-NazeihM.Botros- Dreamtech Press (Available through John Wiley – India and Thomson Learning), 2006 Edition

REFERENCE BOOKS:

1. **Verilog HDL** –Samir Palnitkar, Pearson Education
2. **VHDL** –Douglas Perry, TMH
3. **Fundamentals of Digital Logic with Verilog Design**-Stephen Brown, TMH
4. **Circuit Design with VHDL**-VolneiA.Pedroni, PHI



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V SEMESTER

MEDICAL ELECTRONICS

Subject Title	BIOMECHANICS AND REHABILITATION ENGG	Credits	4
Sub.Code	12ML5DCBMR	L-T-P	4-0-0

Course Outcomes

- Co1: Understand the need & advantages of Sources of Bio Physiological Transducers, Biosensors and its types
- Co2: Understand the principles of potentials and the Electrodes and its types.
- Co3: Understand the working principles of recording instruments for biomedical applications
- Co4: Understand working principles of Blood flow meters, Oximeters and pulmonary function analyzers
- Co5: Learn working principles of Blood cell counters and Audiometer

UNIT I

[12 hours]

Introduction To Biomechanics –What Is Biomechanics, Mechanics In Physiology. Definition Of Stress ,Strain And Strain Rate ,The Non viscous Fluid, Newtonian Viscous Fluid, The Hookean Elastic Solid, Viscoelasticity, Response Of A Viscoelastic Body To Harmonic Excitation, Use Of Viscoelastic Models ,Methods Of Testing .

The Flow Properties of Blood-Blood rheology,the constitutive equation of blood based on viscometric Data and Casson's equation, Laminar flow of blood in tube, blood with viscosity described by Casson's equation, Fluid –mechanical interaction of red blood cells with solid wall, Thrombus formation and dissolution, medical application of blood rheology, Apparent viscosity and relative viscosity, effect of size of the blood vessel on the apparent viscosity of blood- The Fahraeus-Lindqvist Effect, the Motion of red cells in tightly fitting Tubes.

UNIT II

[08 hours]

Bioviscoelastic fluids : Introduction, small deformation experiments, mucus from the respiratory tract, saliva, cervical mucus and semen ,synovial fluid, flow properties of synovial fluid,

Bioviscoelastic solids: Introduction, some elastic materials-actin, elastin, resilin and abductin, fibers, collagen, Quasi-linear viscoelasticity of soft tissues, the concept of pseudo-elasticity



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UNIT III

[12 hours]

Introduction to Rehabilitation and Rehabilitation Team: What is Rehabilitation? Epidemiology of Rehabilitation, Health, Levels of Prevention, Preventive Rehabilitation, Diagnosis of Disability, Functional, Diagnosis, Importance of Physiatry in Functional Diagnosis, Impairment Disability Handicap, Primary and Secondary disabilities, Effects of Prolonged inactivity and Bed rest on body system.

Rehabilitation Team: classification of members, The Role of members, The Role of Physiatrist, Occupational therapist, Recreation therapist, Prosthetist- Orthotist, speech pathologist, Rehabilitation nurse, social worker, Corrective Therapist, Psychologist, Music therapist, Dance therapist and Biomedical Engineer

UNIT IV

[10 hours]

Therapeutic Exercise Technique:

Co-ordination exercises, Freckles exercises, Gait analyses-pathological Gaits, Gait Training, Relaxation Exercises- Methods for training Relaxation , Strengthening exercises-strength training, Types of contraction , Mobilization exercises, Endurance Exercises

UNIT V

[10 hours]

Principles in management of communication:

Impairment –introduction to communication, Aphasia, Types of Aphasia, Treatment of aphasic patient, Augmentative communication-general form of communication, types of visual aids, Hearing aids, Types of conventional hearing aid, writing aids.

TEXT BOOKS:

1. Biomechanics- Mechanical Properties of Living tissues -Y.C.Fung -Second Edition- Springer Verlag.
2. Text book of Rehabilitation- S Sunder- 3rd Edition-Jaypee Brothers Medical Publishers(P) Ltd. New Delhi



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Subject Title	Digital Signal Processing	Credits	5
Sub.Code	11ES5GCDSP	L-T-P	4-0-1

Course Outcomes

- Co1: Understand the convolution principles, use of tabular and circular arrays
- Co2: Understand DFT and its computation techniques.
- Co3: Understand $2N$ point DFT and its computation techniques
- Co4: Realization of digital systems and design of digital filters
- CO5: Realization of FIR filters and frequency response of the systems

UNIT I

[11 hours]

Introduction to DSP, Sampling and reconstruction of a discrete time signal in the frequency domain. Definition of Discrete Fourier Transform (DFT) Useful properties of DFT : linearity, circular shift, Multiplication by a complex exponential sequence, Properties of even and odd parts of $x[n]$, Multiplication, Parseval's relation, Circular Convolution in the time domain, use of tabular arrays and circular arrays

UNIT II

[10 hours]

Use of DFT in linear filtering, linear convolution of two finite duration sequences, overlap add and save methods. **Relation between DFT and other transforms.** Direct computation of DFT. Necessity for efficient computation of DFT. Radix 2 Fast Fourier Transform (FFT) algorithm for DFT computation. Decimation in time algorithm, decimation in frequency algorithms.

UNIT III

[10 hours]

Computation of $2N$ point DFT of a real sequence using single N point DFT. Computation of N point DFT of a real sequence using N point DFT. Decomposition for ' N ', a composite number,. Number of computations, number of multiplications, computational efficiency, Radix 2 FFT algorithm for computation of Inverse Discrete Fourier Transform. (IDFT).



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UNIT IV

[11 hours]

Introduction to realization of digital systems, block diagrams, representation, Realization of Infinite Impulse Response (IIR) systems : direct form, parallel form, cascade form. Introduction to IIR filters, impulse invariant & bilinear transformations, Design of analog filters: Design of Digital filters: Butterworth and Chebyshev. Frequency transformations.

UNIT V

[10 hours]

Realization of Finite Impulse Response (FIR) systems : Direct Form, Linear Phase Form. Introduction to FIR filters, Frequency response of ideal digital low pass filter, high pass filter, frequency sampling technique of designing FIR filters, Windowing,. Design of FIR filters using rectangular , triangular, Hamming, Hanning and Blackman window. Gibbs phenomenon (qualitative discussion only), comparison between IIR and FIR filters.

LAB EXPERIMENTS: Display of basic elementary signals, sampling theorem, basic operations on sequences (shifting, folding, time scaling and multiplication), linear and circular convolution, cross and auto correlation, linear convolution and correction using FFT algorithm, FFT of Sequence, FIR Filter design-LP,HP,BP and Notch filter, FIR filter design using Hamming and Kaiser window for the given order and cut-off frequency, Design of IIR FILTER-LP,HP (using both hardware and software).

TEXT BOOKS:

- 1. Digital Signal Processing,** A computer based approach, Sanjit K Mitra, Tata McGrawHill, Third Edition,
- 2. Digital Signal Processing, Principles, Algorithms and Applications,** John G. Proakis, Dimitris K Manolakis,, Pearson education/PHI, (4th Edition)



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REFERENCE BOOKS:

- 1. Fundamentals of Digital Signal Processing**, Lonnie Ludeman, John Wiley & Sons; Wiley International 1st Edition, 1988.
- 2. Discrete-Time Signal Processing**, Alan V. Oppenheim, Ronald W. Schaffer, John R. Buck, **Prentice-Hall Signal Processing Series, 2nd Edition**, 1999
- 3. Understanding Digital Signal Processing**, **Richard G. Lyons** Prentice Hall, March 25, 2nd Edition 2004
- 4. Digital Signal Processing: Fundamentals and Applications**, [Li Tan](#), Academic Press, 7. 1st edition 2007 i. 9. 10. Find all the books, read about the author, and more. See 12. Are you an author?
- 5. Schaum's Outline of Digital Signal Processing**, Monson Hayes, McGraw- Hill, 1st edition, 1998)



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	MEDICAL IMAGING	Credits	3
Sub.Code	12ML5DCMIG	L-T-P	3-0-0

Course Outcomes

- Co1: Understand the basics of X-ray imaging modality and its biological effects.
- Co2: Understand the fundamentals of CT imaging
- Co3: Understand the principles of ultrasound imaging and its biological effects.
- Co4: Understand the principles of Radionuclide imaging.
- Co5: Understand the fundamentals of Magnetic resonance imaging and MRI

UNIT 1

X-ray Imaging

[09 hours]

Fundamentals of X-ray – Electromagnetic radiation, Interactions between X-rays and matter, Intensity of X-ray beam, Attenuation, Generation and Detection of X-rays – X-ray generation, X-ray generators, Filters, Beam restrictors and grids, Intensifying screens, fluorescent screens, and image intensifiers, X-ray detectors, X-ray image characteristics – Spatial resolution, Image noise, Image contrast, Receiver operating curve (ROC), Biological effects of ionizing radiation. Conventional X-ray radiography, Fluoroscopy, Angiography, Mammography and Xeroradiography, Image subtraction.

UNIT-2

CT Imaging

[07 hours]

Computed Tomography: Conventional tomography, Computed tomography – Projection function, Algorithms for image reconstruction, CT number, Image artifacts, Spiral CT. Recent developments – Digital radiography, Digital subtraction angiography (DSA), 3D reconstruction, Dynamic spatial reconstructor (DSR).

UNIT 3

Ultrasound Imaging

[07 hours]

Fundamentals of acoustic propagation - Stress strain relationship, Characteristic impedance, Intensity, Reflection and refraction, Attenuation, absorption & scattering, Doppler effect, Generation and detection of Ultrasound-Piezoelectric effect, Ultrasonic transducers, Transducer beam characteristics-Huygen's principle, Beam profiles, Pulsed ultrasonic field, Axial and Lateral resolution, Focusing, Arrays.



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Ultrasonic Diagnostic Methods

Pulse echo systems- Amplitude mode (A-mode), Brightness mode (B-mode), Motion mode (M-mode), Constant depth mode (C-mode), Doppler methods, Duplex imaging, Tissue characterization, Colour Doppler flow imaging, Power Doppler Imaging, Image characteristics – Ultrasonic texture or speckle, Speckle reduction, Compensation of phase aberration, Biological effects of ultrasound, video printers.

UNIT-4

Radionuclide Imaging

[07 hours]

Introduction, Fundamentals of Radioactivity – Nuclear particles, Nuclear activity and half-life, Units of measuring nuclear activity, Specific activity, Interaction of nuclear particles and matter, Attenuation of Gamma radiation, Radionuclides, Generation & Detection of Nuclear Emission – Radionuclide generators, nuclear radiation detectors, Collimators, Diagnostic methods using radiation detector probes – Thyroid function test, Renal function test, Blood volume measurement, Radionuclide imaging systems- Rectilinear scanner, Scintillation camera, SPECT, PET.

UNIT-5

Basics of Magnetic Resonance Imaging

[09hours]

Fundamentals of nuclear magnetic resonance- Angular momentum, magnetic dipole moment, magnetization, Larmor frequency, Rotating frame of reference and RF magnetic field, Free induction decay (FID), Fourier spectrum of the NMR signal, Spin density, Relaxation times, Pulse sequences.

MRI System & Imaging Methods.

Introduction, Magnet, Room temperature and magnetic field gradients, NMR Coil/Probe, Transmitter, Receiver, Data acquisition. Imaging Methods- Introduction, slice selection, frequency encoding, phase encoding, Spin-Echo imaging- Gradient echo imaging, Blood flow imaging, Characteristics of MRI images- Spatial resolution, image contrast. Biological effects of magnetic fields- Static magnetic fields, Radio-frequency fields, Gradient magnetic fields, Imaging safety, Functional MRI.

Textbooks:

1. Principles of Medical Imaging by Kirk Shung, Michael B. Smith and Benjamin Tsui, Academic Press, 1992.
2. Handbook of Biomedical Instrumentation – by R.S.Khandpur, 2nd Edition, Tata McGraw Hill, 2003.
3. Fundamentals of Medical Imaging by Paul Suetens, Cambridge University Press, 2002.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	BIOMEDICAL INSTRUMENTATION AND BIOSENSOR	Credits	5
Sub.Code	12ML5DCBMI	L-T-P	4-0-1

Course Outcomes

- Co1: Understand the need & advantages of Sources of Bio Physiological Transducers, Biosensors and its types
- Co2: Understand the principles of potentials and the Electrodes and its types.
- Co3: Understand the working principles of recording instruments for biomedical applications
- Co4: Understand working principles of Blood flow meters, Oximeters and pulmonary function analyzers
- CO5: Learn working principles of Blood cell counters and Audiometer

UNIT I

[10 hours]

Fundamentals of Medical Instrumentation: Sources of biomedical signals, Basic medical instrumentation system, performance requirements of medical instrumentation systems, Intelligent medical instrumentation Systems, General constraints in design of medical instrumentation systems. Bioelectric Signals and Electrodes: Origin of Bioelectric signals - Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrooculogram (EOG), Electroretinogram (ERG), Recording Electrodes – Electrode-tissue interface, polarization, skin contact impedance, motion artifacts, Silver-Silver Chloride electrodes, Electrodes for ECG, Electrodes for EEG, Electrodes of EMG, Electrical conductivity of electrode jellies and creams, microelectrodes.

UNIT II

[12 hours]

Physiological Transducers: Classification of transducers, performance characteristics of transducers. Pressure transducers, transducers for body temperature measurement, photoelectric transducers, optical fiber sensor, biosensor and smart sensor

Biosensors: Introduction, Acetic Acid sensor, Alcohol sensor, Glutamic Acid Sensor, Carbon Dioxide Sensor, Electrochemical Determination of Cell Number, Dye-coupled Electrode system for Determination of Cell Number in Wastewater, preliminary screening of Mutagens with Microbial Sensor, Ammonia Sensor, Nitrogen Dioxide Sensor, BOD sensor.



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UNIT III

[8 hours]

Biomedical Recorders: Electrocardiograph, vectorcardiograph, phonocardiograph, Electroencephalograph, Electromyograph, other biomedical recorders and biofeedback instruments.

UNIT IV

[12 hours]

Oximeters: Oximetry, ear oximeter, pulse oximeter, skin reflectance oximeter and intravascular oximeter.

Blood Flow Meters: Electromagnetic blood flow meters-different types, Ultrasonic blood flow meters, NMR blood flow meters, Laser Doppler blood flow meters..

Pulmonary Function Analyzer: Pulmonary function measurement, Spirometry, Pneumotachometer, Measurement of volume by Nitrogen washout technique.

UNIT V

[10 hours]

Blood cell counters: Types of blood cells, methods of cell counting, Coulter counter, automatic recognition and differential counting of cells.

Audiometer and Hearing Aids: Mechanism of hearing, measurement of sound, basic audiometer, pure-tone audiometer, speech audiometer, audiometer system, Bekesy evoked response audiometer system, calibration of audiometer and hearing aids.

Patient Safety: Electric shock hazards, Leakage currents, safety codes and analyzer.

TEXT BOOK:

1. Handbook of Biomedical Instrumentation – by R.S.Khandpur, 2ndEdition, Tata McGraw Hill, 2003
2. Bioinstrumentation and biosensors— edited by Donald L.Wise---Marcel Dekker .Inc-2009



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	DATA STRUCTURES WITH C++	Credits	4
Sub.Code	12ML5DCDSC	L-T-P	3-0-1

Course Outcomes

- Co1: Understand the need of Object oriented programming and its relevance in the context of Structures and Functions
- Co2: Learn the concepts and relevance of Classes & Objects
- Co3: Understand the concept of Operator Overloading and inheritance for effective programming.
- Co4: Understand advanced concepts about functions and programming techniques for working with files.
- CO5 : Understand different types of Data structures

UNIT 1

[8 hours]

C++ programming Basics: Need of object oriented programming, procedural languages, characteristics of OOP, preprocessor directives, data types, manipulators. **Structures:** Structures, enumerated data types, Boolean type, **Functions:** passing arguments, returning values, reference arguments, overloaded functions, inline functions, Default arguments, variable and storage classes.

UNIT 2

[7 hours]

Objects and classes: objects as data types, constructors, destructors, overloaded constructors. **Arrays:** Arrays as class member data types, passing arrays, arrays as objects, strings, arrays of strings. **Pointers:** Pointer data types and pointer variables.

UNIT 3

[7hours]

Operator overloading: over loading of unary operators, binary operators, data conversion. **Inheritance:** Derived class and base class, overriding member functions, scope resolution, class Hierarchies, Public and Private inheritance, levels of inheritance, multiple inheritances.



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UNIT 4

[7 hours]

Functions: Virtual functions, Friend functions, Static functions. **Files and Streams:** Streams, String I/O, Character I/O, Object I/O, I/O with multiple Objects. **Standard Template Library:** Components of STL, Sequence Container: Vector, Iterators.

UNIT 5

[10 hours]

Data structures: Linked list: PROPERTIES, traversing, insertion, deletion and building a linked list. Implementation of Stacks and Queues as arrays and linked list. Theoretical concepts of Binary Trees and Binary Tree Traversal. Theoretical concept on Recursion, Direct & indirect Recursion, infinite Recursion.

Lab experiments: Lab components must comprise of programs that reinforce the theoretical understanding of the corresponding subject. Programs would address concepts of Structures, Classes, Objects, Operator overloading, Inheritance, Linked List, Stacks and Queues using Array and Linked list.

Text Books:

1. Object oriented programming in TURBO C++, Robert Lafore, Galgotia Publications.2002
2. Data Structures using C++, D.S. Malik, Thomson, 2003.

Reference Books:

1. Object Oriented Programming with C++, E Balaguruswamy, Third edition, TMH2006
2. C++ the complete reference, Herbert Schildt, Fourth edition, TMH, 2003
3. Data Structures, Algorithms and Applications in C++: Sartaj Sahni, Tata McGrawHill Publications.



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SEMESTER
MEDICAL ELECTRONICS

Subject Title	BIOMEDICAL DIGITAL SIGNAL PROCESSING	Credits	4
Sub.Code	10ML6DCBSP	L-T-P	3-0-1

Course Outcomes

- Co1: Understand the filters concepts and design filters for bio-signal processing.
- Co2: Understand the processing concepts for analysis of bio-signals such as ECG, EMG, EEG etc.
- Co3: Learn the Algorithms for detection and compression of bio-signals
- CO4: Understand the analysis of cardiological signal processing concepts
- CO5: Learn neurological signal Processing concepts and algorithms.

UNIT I

[6 hours]

Introduction to Biomedical Signals :The nature of biomedical signals, The action potential, objectives of biomedical signal analysis, Difficulties in biomedical signal analysis, computer aided diagnosis.

Signal Averaging: Basics of signal averaging, a typical signal averager, signal averaging as a digital filter

UNIT II

[8 hours]

Filtering for removal of artifacts: Introduction, Random noise, structured noise and physiological interference, stationary versus non stationary process Adaptive filters: Principle of an adaptive filter, the steepest – Descent algorithm, adaptive noise canceller, cancellation of 60 Hz interference in electrocardiography, applications of adaptive filters. Canceling Donor-heart interference in Heart-transplant electrocardiography, Cancellation of ECG signal from the electrical activity of the chest muscles, canceling of maternal ECG in fetal ECG, Cancellation of High frequency noise in Electro-surgery.

UNIT III

[9 hours]

FIR filters: Characteristics of FIR filters, smoothing filters, notch filters, derivative filters. IIR filters: Generic Equation of IIR filters, simple one pole filter. Integer Filters: Low pass, band pass and High pass filters. Data Compression Techniques: Lossy and Lossless data reduction Algorithms. ECG data Compression using Turning point, AZTEC, and Hoffman coding technique.

UNIT IV

[8 hours]



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Cardiological Signal Processing: Pre-processing. ECG QRS Detection techniques. Rhythm analysis. Arrhythmia detection Algorithms. Automated ECG Analysis. ECG Pattern Recognition. Heart rate variability analysis, ST-segment analyzer, portable, arrhythmia analysis monitoring, long term continuous ECG recording.

UNIT V

[8 hours]

Neurological signal processing: The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics, EEG analysis, Linear prediction theory, The Autoregressive (AR) method, Recursive estimation of AR parameters, Spectral error measure, Adaptive segmentation, Transient detection and elimination- The case of epileptic patients, overall performance.

LAB EXPERIMENTS: Read and plotting of ECG data, spectrum of ECG with 50 HZ noise, Signal Averaging to Improve the SNR for an ECG and EEG signals, Realization of IIR filters for ECG analysis, Design of FIR Filter for ECG, Integer filters for ECG, PSD estimation for ECG, EEG, and EMG. ,

QRS detection and Heart rate determination, Correlation and Template matching, Realization of Notch filter for removal of line interference, Data Compression Techniques: AZTEC, TP algorithms.

Note: The above experiments are to be conducted Using Matlab/ "C" language.

TEXT BOOKS:

1. Biomedical Digital Signal Processing, Willis J. Tompkins, PHI,
2. D.C.Reddy, Biomedical Signal Processing- principles and techniques, Tata McGraw-Hill, 2005
3. Rangaraj M. Rangayyan – Biomedical Signal Analysis. IEEE Press, 2001.
4. Wavelet Transforms by Raghuvver M. Rao and Ajit S. Bopardikar, Pearson, 1998.

REFERENCE BOOKS:

1. Akay M , Biomedical Signal Processing, Academic: Press 1994
2. Cohen.A, Biomedical Signal Processing -Vol. I Time & Frequency Analysis, CRC Press, 1986.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	COMMUNICATION SYSTEMS	Credits	4
Sub.Code	12ML6DCCNS	L-T-P	3-0-1

Course Outcomes

- Co1: Understand basics of Analog and Digital communication systems.
- Co2: Understand the types of Modulation and Demodulation Techniques used in analog and digital communication systems
- Co3: Learn about the different types of Transmission and Detection techniques
- Co4: Understand the difference between analog and digital communication transmitters and receivers with noise characteristics.
- Co5: Understand the baseband signal characteristics such as bandwidth, channel capacity and Different schemes used for digital modulation

UNIT I

[9 hours]

AMPLITUDE MODULATION – Introduction, time and frequency domain description, generation and detection of AM .DSBSC-time and frequency domain representation, generation and detection of DSBSC.

SSB – time and frequency domain representation, generation and demodulation of SSB Comparison of AM techniques, application of AM in radio broadcasting.

UNIT II

[8 hours]

ANGLE MODULATION – Basic concepts ,Frequency Modulation, spectrum analysis of Sinusoidal FM wave. NBFM,WBFM, Constant average power, Transmission band width of FM waves, Generation of FM waves. Direct FM, Demodulation of FM waves, Frequency discriminator, ZCD,PLL (1st order) of AM and FM.

UNIT III

[7 hours]

NOISE IN ANALOG MODULATION –Signal to noise Ratios,AM Receiver Model,Signal to Noise ratios for Coherent Reception.,DSBSC receiver, SSB receivers, threshold effect, noise in FM receiver, FM threshold. Noise in FM Reception ,Pre-emphasis and De-Emphasis in FM.



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UNIT IV

[8 hours]

PULSE MODULATION: Sampling theorem for low pass and band pass signal, statement and proof, PAM, Channel bandwidth for a PAM signal. Natural sampling, Flat-Top sampling, Signal recovery through Holding, Quantization of signals, Quantization error, PCM, Electrical representations of Binary digits, The PCM systems, DPCM, Delta Modulation, ADM.

UNIT V

[7 hours]

DIGITAL MODULATION: Introduction, Binary shift keying, DPSK, QPSK, Type D Flip-Flop, QPSK Transmitter, Non-offset QPSK, QPSK receiver.

LAB EXPERIMENTS: Amplitude Modulation: Collector modulation, Frequency Modulation- Using IC 8038. Demodulation of AM, Mixers, Analog Multiplexer - FDM TDM.- using IC'S, Digital Modulation- Generation & Recovery of ASK, FSK, BPSK, Digital Modulation- Generation & Recovery of PAM, PWM, Frequency Demodulator -Using Phase Locked Loop IC.

TEXT BOOKS:

1. An introduction to analog and digital communication - Simon Haykin
2. Communication systems – Simon Haykin, John Wiley & Sons.

OUTCOME: Develop hands-on experience in using computers to process images Familiarize with MATLAB Image Processing Toolbox. Develop critical thinking about shortcomings of the state of the art in image processing



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Subject Title	Digital Image Processing	Credits	5
Sub.Code	10ML6DCDIP	L-T-P	4-0-1

Course Outcomes

CO1: Understand the fundamental concepts of image and image processing.

CO2: Learn the use of transforms for image processing applications like coding and enhancement.

Co3: Learn different segmentation methods for object detection.

Co4: Learn image restoration techniques.

Co5: Learn image compression techniques.

UNIT I

[10 hours]

Fundamentals: Introduction, Fundamental steps in DIP, Components of DIP system, A simple image formation model, Image sampling and quantization, Basic relationship between pixels, Color image processing fundamentals related with all color Models

UNIT II

[12 hours]

Image Enhancement in Spatial Domain: Background, Point processing – Image negatives, Log transformations, Power law transformations, Contrast stretching, Gray level slicing, Bit plane slicing, Histogram processing– Histogram equalization, Histogram matching (specification), Local enhancement, Arithmetic/Logic operations – Image subtraction, Image averaging, Basics of spatial filtering, Smoothing spatial filters – Smoothinglinear filters, order statistics filters Sharpeningspatial filters – Foundation, TheLaplacian, The Gradient.

UNIT III

[8 hours]

Image Enhancement in Frequency Domain: Background, Basic properties of the frequencydomain, Basic filtering in the frequency domain, Basic filters and their properties, Smoothing frequency domain filters – Ideal lowpass filters, Butterworth lowpass filters, Gaussian lowpassfilters, Sharpening frequency domain filters – Ideal highpass filters, Butterworth highpassfilters, Gaussian highpass filters, Homomorphic filtering.



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UNIT IV

[10 hours]

Image Restoration: Image degradation/restoration model, Noise models, Restoration using spatial filtering – Mean filters, Geometric mean filters, Harmonic mean filters, Median filter, Max & min filters, Midpoint filter.

Noise filtering by frequency domain filtering– Band reject filters, Band pass filters, Notch filters, Inverse filtering, Minimum mean square error (Wiener) filtering.

UNIT V

[12 hours]

Image Compression: Fundamentals, Variable length coding, LZW coding, Bit plane coding, Constant area coding, Run length coding, Lossless predictive coding, Lossy predictive coding, Transform coding, Image compression standards – Basic, JPEG.

Image Segmentation: Introduction, Thresholding: Threshold detection methods, Optimal thresholding, Multi-spectral thresholding, Edge-based segmentation: Edge image thresholding, Border tracing, Hough transform, Region-based segmentation –Region merging, Region Splitting & merging. Matching, Matching criteria

LAB EXPERIMENTS: Simulation and display of an image and its negative (Binary & Gray scale), relationship between pixels, transformation of image, Image enhancement techniques, Bit planes, Computation of Mean SD and Correlation Coefficient. Image smoothing and sharpening filters, Edge detection with gradient filters, image restoration, intensity slicing and segmentation.

TEXT BOOK:

Digital Image Processing by Rafael C. Gonzalez & Richard E. Woods, Third Edition. Pearson Education Inc

REFERENCE BOOKS:

1. **Digital Image Processing** by Rafael C. Gonzalez & Richard E. Woods, First Edition. Pearson Education Inc.
2. **Fundamentals of Digital Image Processing** by Anil K. Jain. Prentice Hall of India.
3. **Image Processing, Analysis and Machine-Vision** by Milan Sonka, Vaclav Hlavac & Roger Boyle, Second Edition



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Subject Title	BIOMEDICAL EQUIPMENTS	Credits	4
Sub.Code	12ML6DCBME	L-T-P	3-0-1

Course Outcomes

- Co1: Understand the patient Monitoring system concepts
- Co2: Understand the principle of cardiac output measurements
- Co3: Learn the working principle of Instruments for surgery, physiotherapy, Electrotherapy Equipments and Haemodialysis Machine.
- Co4: Understand the principles of Blood Gas Analyzers, ventilators and Automated Drug delivery Systems.
- CO5: Understand the Applications of Lasers in Biomedical field.

UNIT I

[07 hours]

Patient Monitoring Systems: System concepts, cardiac monitor, bedside patient monitoring system, central monitors, measurement of heart rate, measurement of pulse rate, blood pressure measurement, measurement of temperature, measurement of respiratory rate, catheterization laboratory instrumentation.

UNIT II

[8 hours]

Cardiac output measurements: Indicator dilution method, Dye dilution method, Thermal dilution techniques, Measurement of continuous cardiac output derived from the aortic pressure waveform, Impedance technique

Cardiac Pacemakers: Need for cardiac pacemaker, External Pacemaker, Implantable pacemaker, Types of Implantable pacemakers, pacing system Analysers,

Defibrillators: Need for Defibrillator, Dc defibrillators, Implantable Defibrillators, Defibrillator analyzers

UNIT III

[9 hours]

Instruments for Surgery: Principles of surgical diathermy, surgical diathermy Machine, safety aspects in electro- surgical units, surgical diathermy Analyzer.

Physiotherapy and Electrotherapy Equipments: High frequency heat therapy, Short-wave diathermy, microwave diathermy, ultrasound therapy unit, Electro diagnostic therapeutic apparatus, pain relief through electrical Stimulation, bladder and cerebella stimulators.



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Haemodialysis Machine: Artificial kidney, dialyzer, Membranes for haemodialysis.

Lithotriptors: Stone disease problems, lithotripter machine, extra-corporeal Shock wave therapy.

Anesthesia Machine: Need for anesthesia, anesthesia Machine.

UNIT IV

[8 hours]

Blood Gas Analyzers: Acid-base balance, blood pH measurement, measurement of blood pCO₂, intra-arterial blood gas monitoring, complete blood gas analyzer

Ventilators: Artificial ventilation, ventilators, types of ventilators, ventilators terms, classification of ventilators. Modern ventilators

Automated Drug Delivery Systems: Infusion pumps, components of drugs infusion systems and implantable infusion systems

UNIT V

[7 hours]

Laser Applications in biomedical field:

The Laser, Pulse Ruby Laser, Nd-YAG Laser, Helium-Neon Laser, Argon Laser, Co₂ Laser, Excimer Laser, Semiconductor Lasers, Laser Safety.

Application of optical fibers in medical field- Endoscopes, Endoscopic laser coagulator,

BIOMEDICAL EQUIPMENT LAB EXPERIMENTS-

1. Basic experiments using Lab-View.
 - a. Creating simple VI using numeric controls panel, operate tool and thermometer for output range change.
 - b. Modify the VI to make degree C to degree F converter using multiply and add functions.
 - c. Program for converting VI to sub-VI.
 - d. Using FOR LOOP functions for Random Number Generator with delay program.



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- e. Use the analog single point VI to measure Board 1, channel 1. Put into a for loop of 100 values and display the measurements on wave form charts.
 - f. Measurement of temperature using thermocouple by using 9472 (DAQ).
 - g. Temperature (Lower/Upper Limit) by 6008 (DAQ).
 - h. EXE file generation.
2. Lab VIEW based cardio-respiratory monitor.
 3. Design and Development of a Knowledge based ECG Data monitoring and Diagnostic Tool in Lab-view.
 4. Heart Rate Variability Measurement
 5. Arrhythmia Detection Based on Virtual Instrumentation.
 6. Alarm clock based on sleep state of human using Lab VIEW.
 7. Computerized respiratory sounds analysis using Lab VIEW.
 8. Lab VIEW based ECG & Temperature bio-telemetry unit.
 9. Systems, methods & computer program products for monitoring, diagnosing & treating medical conditions of remotely located patients.
 10. Hospital Visit; Study of Biomedical equipments through Hospital Visit.

TEXT BOOK:

1. Handbook of Biomedical Instrumentation – by R.S.Khandpur, 2nd Edition, Tata McGraw Hill, 2003.
2. Biomedical Instrumentation by Dr.M. Arumugam-Second Edition- 1994



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VII SEMESTER

MEDICAL ELECTRONICS

Subject Title	COMPUTER COMMUNICATION NETWORKS	Credits	5
Sub.Code	12ML7DCCCN	L-T-P	4-0-1

Course Outcomes

- Co1: Understand network functional components and their interaction.
- Co2: Learn the various network protocols.
- Co3: Learn the different network models.
- Co4: Understand IEEE and Ethernet standards.
- CO5: Understand different Routing protocols.

UNIT – 1

[8 hours]

Layered tasks, OSI Model, Layers in OSI model, TCP/IP Suite, Addressing, Telephone and cable networks for data transmission, Telephone networks, Dial up modem, DSL, Cable TV for data transmission.

UNIT – 2

[12 hours]

Datalink control: Framing, Flow and error control, Protocols, Noiseless channels and noisy channels, HDLC. **Multiple accesses** Random access, Controlled access.

UNIT – 3

[7 hours]

Wired LAN, Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11.

UNIT – 4

[13 hours]

Connecting LANs, Backbone and Virtual LANs, Connecting devices, Back bone Networks Virtual LANs, Transport layer Process to process Delivery, UDP, TCP, Domain name system.



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UNIT – 5

[12 hours]

Network Layer, Logical addressing, Ipv4 addresses, Ipv4, Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing protocols.

Lab experiments: - CCN programming using C/C++

TEXT BOOK:

1. **Data Communication and Networking**, B Forouzan, 4th Ed, TMH 2006

REFERENCE BOOKS:

1. **Computer Networks**, James F. Kurose, Keith W. Ross: Pearson education, 2nd Edition, 2003
2. **Introduction to Data communication and Networking**, Wayne Tomasi: Pearson education 2007



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Subject Title	LINEAR ALGEBRA	Credits	5
Sub.Code	11ML7DCLNA	L-T-P	4-0-1

Course Outcomes

- Co1: Understand the system of linear equations and its solution using row echelon form and LU factorization
- Co2: Understand elements of vector spaces.
- Co3: Learn linear transformations and least square approximations to solve inconsistent systems.
- Co4: Learn Orthonormal vectors using Gram-Schmidt process and QR factorization.
- Co5: Understand concepts in Eigen spaces and its applications

UNIT 1

[10 hours]

Linear equations: Fields; system of linear equations, and its solution sets; elementary row operations and echelon forms; matrix operations; invertible matrices, LU-factorization.

UNIT 2

[12 hours]

Vector spaces: Vector spaces; subspaces; linear independence, span, null spaces, bases and dimension;

UNIT 3

[10 hours]

Linear Transformations: Matrices as linear transformation, Inner Product Spaces, least-squares problems

UNIT 4

[10 hours]

Orthogonal bases, orthogonal matrices, Gram-Schmidt process; QR-factorization;

UNIT 5

[10 hours]

Eigenvalue and eigenvectors-Characteristic value, Eigen vector, Diagonalization
Applications-differential equations, Fibonacci Sequences. Singular value decomposition.



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Lab Experiments: Implementation of Linear Algebra concepts for Medical Image and Signal processing

TEXTBOOKS:

1. Elementary Linear Algebra, by Richard O Hill, International Education Academic Press College Division
2. Gilbert Strang, "Linear Algebra and its Applications", 4th Edition, Thomson Learning Asia, 2007

REFERENCE BOOKS

1. David C. Lay, "Linear Algebra and its Applications", 3rd Edition, Pearson Education (Asia) Pvt. Ltd, 2005.
2. Bernard Kolman and David R. Hill, "Introductory Linear Algebra with Application" Pearson (Asia) Ltd, 7th edition, 2003



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	Intellectual Property Rights	Credits	2
Sub.Code	11HS8GCIPR	L-T-P	2-0-0

Course Outcomes

- Co1: Understand the basic principles of IP laws.
- Co2: Understand the basics, procedure and specifications of Patents.
- Co3: Understand the rights, transfer and infringements of patents.
- Co4: Understand the basics, ownership and infringements of copyright.
- CO5: Understand the need, registration, licensing and infringements of trademark.

UNIT I

[5 hours]

Basic principles of IP laws: Introduction, Concept of property, Need for a holistic approach, Constitutional aspects of IP, Evolution of the patent system in UK, US and India, Basis for protection, Invention, Criteria for patentability, Non – patentable inventions.

UNIT II

[6 hours]

Patents: Introduction, Origin and meaning of the term patent, Objective of a patent law, the legislative provisions regulating patents, principles underlying the patent law in India, patentable invention.

Procedure for obtaining patent: Submission of application, Filing provisional and complete specification, Examination of the application, advertisement of the acceptance, opposition, Grant and sealing of patent, Term of the patent, compulsory license.

Provisional and complete specification: Definition of Specification, Kinds of specification, provisional specification, complete specification, Claims, Conditions for amendment.

UNIT III

[5 hours]

Rights conferred on a patentee: Patent rights, Exception and limitations, Duties of a Patentee.

Transfer of patent: Forms of transfer of Patent rights, Assignment, kinds of assignment, License, kinds of license, Rights conferred on a licensee, Transmission of patent by operation of law.

Infringement of patents: Construction of claims and infringement, patents held to be infringed, patents held to be not infringed.

Action for Infringement: Where a suit is to be instituted, procedure followed in the suit,



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Onus of establishment infringement, Defence by the defendant, The Relief's, Injunction, Damages or account of profits, patent agents, patent drafting, database searching, and Case studies.

UNIT IV

[6 hours]

Copy Right: Meaning and characteristics of copy right, Indian copy right law, requirement of copy right, Illustrations copy right in literary work, Musical work, Artistic work, work of architecture, Cinematograph film, sound recording.

Author and Ownership of copy right: Ownership of copy right, Contract of service, Contract for service, rights conferred by copy right, terms of copy right, license of copy right.

Infringement of copy right: Acts which constitute infringement, general principle, direct and indirect evidence of copying, Acts not constituting infringements, Infringements in literary, dramatic and musical works, Remedies against infringement of copy right, Case studies.

UNIT V

[4 hours]

Trade Marks: Introduction, Statutory authorities, procedure of registration of trademarks, rights conferred by registration of trademarks, licensing in trade mark, infringement of trade mark and action against infringement.

Text Books:

1. Dr. T Ramakrishna, "**Basic principles and acquisition of Intellectual Property Rights**", CIPRA, NSLIU -2005.
2. Dr.B.L.Wadehhra, "**Intellectual Property Law Handbook**", Universal Law Publishing Co. Ltd., 2002.

References:

1. Dr. T Ramakrishna , "**Ownership and Enforcement of Intellectual Property Rights**" , CIPRA, NSLIU -2005.
2. "**Intellectual Property Law (Bare Act with short comments)**", Universal Law Publishing Co. Ltd.. 2007.
3. "**The Trade marks Act 1999 (Bare Act with short comments)**", Universal Law Publishing Co. Ltd., 2005.
4. "**The Patents Act, 1970 (Bare Act with short comments), as amended by Patents (Amendment) Rules 2006 w.e.f. 5-5-2006**". Commercial law publishers (India) Pvt. Ltd., 2006.
5. Thomas T Gordon and Arthur S Cookfair, "**Patent Fundamentals for Scientist and Engineers**", CRC Press 1995.
6. Prabuddha Ganguli, "**Intellectual Property Rights**", TMH Publishing Co. Ltd, 2001



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	PROJECT MANAGEMENT	Credits	2
Sub.Code	11HS8GCPRM	L-T-P	2-0-0

Course Outcomes

- CO1: Understand the Concepts of Project Management.
- Co2: Understand the concept of Project Establishment: Scope, Time, Cost and Performance Goals.
- Co3: Understand the structure of Organizing Human Resources and learn the process of contracting with reference to management of Projects.
- Co4: Understand Organizing Systems and Procedures for Project Implementation and Project Direction.
- CO5. Analyze Project Direction, Coordination and Control.

UNIT: 1

(06 Hours)

Concepts of Project Management: Concept of Project, Categories of Projects, Project Life Cycle Phases, Project Management Concepts, Tools and Techniques for Project Management, The Project Manager, Basic Education for a Project Manager, Roles and Responsibilities of Project Manager, Project Manager as a Profession, Summary.

UNIT: 2

(05 Hours)

Establishing the Project: Scope, Time, Cost and Performance Goals , Feasibility Report, Financing Arrangements, Preparation of Cost Estimates, Finalization of Project Implementation Schedule, Evaluation of the Project Profitability, Appointing a Project Manager, Fixing the Zero Date, Summary.

UNIT: 3

(05 Hours)

Organizing Human Resources and Contracting, Delegation, Project Manager's Authority, Project Organization, Accountability in Project Execution, Contracts, 'R's of Contracting, Tendering and Selection of Contractors, Team Building, Summary.



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UNIT: 4

(05 Hours)

Organizing Systems and Procedures for Project Implementation, Working of Systems, Design of Systems, Project Work System Design, Work Breakdown Structure (WBS), Project Execution Plan (PEP), Project Procedure Manual, Project Control System, Planning, Scheduling and Monitoring, Monitoring Contracts, Project Diary, Summary.

UNIT:5

(05 Hours)

Project Direction, Coordination and Control, Communications in a Project, Project Coordination, Project Control, Scope/Progress Control, performance control, Schedule Control, Cost Control, Summary.

TEXT BOOKS:

1. Project Management – S Choudary, Tata McGRAW Hill Publishing Company Limited

REFERENCE BOOKS:

1. Project management – David I Cleland – Mcgraw Hill International Edition, 1999.
2. Project Management – Gopalakrishnan – Mcmillan India Ltd.
3. Project Management – Harry-Maylor-Pearson Publication.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	Object oriented Programming USING C++	Credits	4
Sub.Code	10ES5GE10P	L-T-P	4-0-0

Course Outcomes

- Co1: Ability to analyze the concepts of Object Oriented Programming with emphasis on C++, analyzing the program construction, application and structure of C++.
- Co2: Emphasize the importance of Classes, Objects, Data Abstraction, and analyzing function prototype, classes and passing parameters using C++ programs.
- Co3: Ability to analyze the program using applications of constructors and destructors in C++, inheritance, pointers and study of polymorphism.

UNIT I

[10 hours]

Principles of Object oriented programming: OOP Concepts, Program construction, directives, preprocessor directives, header files and library files, Benefits and applications Beginning with C++: Definition, application, structure of C++ program, compiling and linking Tokens, expressions and control structures: Tokens, keywords, identifiers and constants, data types, symbolic constants, variables, operators, manipulators, control statements and loops.

UNIT II

[10 hours]

Functions in C++: Function prototype, argument passing, recursion, inline functions, friend and virtual functions Classes and objects: Class definition and declaration, member functions, static data members and member functions, arrays of objects, returning objects.

UNIT III

[10 hours]

Constructors and destructors: Constructors, parameterized constructors, multiple constructors in a class, copy constructor, dynamic constructors, and destructors. Operator overloading and type conversions: Overloading unary and binary operators, overloading using friends, rules for overloading.



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UNIT IV

[12 hours]

Inheritance: Inheritance, public, private and protected inheritance. Private member inheritance. Types of inheritance: Single, Multilevel, multiple, hierarchical, hybrid. Pointers, virtual functions and polymorphism. Pointers, pointers to objects, this pointer, pointers to derived classes, virtual functions. Constructors in derived class. Managing console I/O operations: C++ streams, C++ stream classes, I/O operations, managing O/P with manipulators.

UNIT V

[10 hours]

Templates: Class templates, function templates, overloading template functions, member function templates and non type template arguments. Exception handling: Basics, throwing and catching mechanisms, rethrowing an exception, specifying exceptions

TEXT BOOKS:

1. **Object oriented Programming with C++**, -E Balagurusamy (TMH Publications, 4th edn)
2. **Object oriented Programming in turbo C++**, Robert L a f o r e (GALGOTIA Publications)

REFERENCE BOOK:

1. **Let Us C++**---Yashavanth P. Kanetkar (BPB Publications)
Programming With C++-----Schaum'sseries (TMH Publications)
2. **Programming With C++**-----Schaum'sseries (TMH Publications)



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	Digital system design using VHDL	Credits	4
Sub.Code	12ES5GE1DD	L-T-P	3-0-1

Objective:

Ability to design, conduct and analyze experiments in the field of Digital Electronics using software tools.

ability to work in teams leading to improvement in team work

ability to identify, formulate and solve problems in Digital Electronics using VHDL

impart education to develop Engineering solutions with an awareness of industry concerns

ability to apply technical knowledge and use engineering tools necessary for engineering practice.

UNIT I

[10 hours]

Introduction: VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries, VHDL model for a counter.

Additional Topics in VHDL: Attributes, Transport and Inertial delays, Operator overloading, Multi-valued logic and signal resolution, IEEE-1164 standard logic, Generics, Generate statements, Synthesis of VHDL code, Synthesis examples, Files and Text IO.

UNIT II

[08 hours]

Designing With Programmable Logic Devices: Read-only memories, Programmable logic arrays (PLAs), Programmable array logic (PLAs), Other sequential programmable logic devices (PLDs), Design of a keypad scanner.

UNIT III

[06 hours]

Designing With Programmable Gate Arrays And Complex Programmable Logic Devices: Xilinx 3000 series FPGAs, Designing with FPGAs, Xilinx 4000 series FPGAs, using a one-hot state assignment, Altera complex programmable logic devices (CPLDs), Altera FELX 10K series CPLDs.



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UNIT IV

[08 hours]

Design Of Networks For Arithmetic Operations: Design of a serial adder with accumulator, State graphs for control networks, Design of a binary multiplier, Multiplication of signed binary numbers, Design of a binary divider.

UNIT V

[07 hours]

Digital Design with SM Charts: State machine charts, Derivation of SM charts, Realization of SM charts. Implementation of the dice game, Alternative realization for SM charts using microprogramming, Linked state machines.

TEXT BOOK:

Charles H. Roth. Jr., **Digital Systems Design using VHDL**, Thomson Learning, Inc, 9th reprint, 2006.

REFERENCE BOOKS:

1. Stephen Brown & Zvonko Vranesic, **Fundamentals of Digital Logic Design** with VHDL, Tata McGraw-Hill, New Delhi, 2nd Ed., 2007
2. Mark Zwolinski, **Digital System Design with VHDL**, 2 Ed, Pearson Education., 2004
3. Volnei A Pedroni, **Digital electronics and Design with VHDL**. Elsevier



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	ESSENTIALS OF INFORMATION TECHNOLOGY	Credits	4
Sub.Code	12ES5GE1IT	L-T-P	3-0-1

UNIT I

[07 hours]

Introduction to Computer Systems - Basics of computer systems - Various hardware components - Data storage and various Memory units - Central Processing Unit - Execution cycle - Introduce to software and its classifications

Operating system concepts- Introduction – Memory management - Process management - Interprocess Communication – Deadlocks - File management - Device management

UNIT II

[08 hours]

Problem solving Techniques - Introduction to problem solving - Computational problem and it's classification - Logic and its types - Introduction to algorithms - Implementation of algorithms using flowchart - Flowcharts implementation through RAPTOR tool - Searching and sorting algorithms - Introduction and classification to Data Structures - Basic Data Structures - Advanced Data Structures

UNIT III

[08 hours]

Programming & Testing - Introduction to Programming Paradigms and Pseudo Code Basic programming concepts - Program Life Cycle - Control Structures - Introduction and Demonstration of 1-D Array and 2-D Array - Code Optimization techniques Structured Programming – Functions – Structures - File Handling - Introduction to Software Development Life Cycle - Industry Coding Standards and Best Practices - Testing and Debugging - Code Review

UNIT IV

[08 hours]

RDBMS- data processing – the database technology – data models
ER modeling concept –notations – Extended ER features
Logical database design - normalization
SQL – DDL statements – DML statements – DCL statements
Joins - Sub queries – Views
Database design Issues



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UNIT V

[08 hours]

Integrated Project - Project Briefing, Project contact sessions and Project evaluation.
Sample exercise on using Embedded SQL /JDBC

Note: The project is a Group Activity consisting of 3/4 members in a team. The Project will be carried out offline for duration of 25-32 hours.

1. Tutorial

The assignments for Operating System Concepts, Problem Solving techniques, Programming & Testing, Object Oriented Concepts and RDBMS have to be completed as a part of Tutorial.

2. Project

Students are required to implement an integrated project using the concepts of Programming & Testing, Object Oriented Concepts and RDBMS. Following activities are involved in Project Development:

Preparation of High level design and Detailed design document,
Unit Test Plan and Integrated Test Plan
Coding and Unit Testing , Integration Testing

Students can use the following to implement the Project:

- Programs using C or C++ or Java Language
- Embedded SQL can be used to connect the Front-End with the backend
- Database systems in case of C/C++
- JDBC can be used to connect Front-End with the backend Database systems in case of Java

TEXT BOOK:

Foundation Program, Volume I, II & III developed by Campus Connect initiative of Infosys



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REFERENCE BOOKS:

1. Andrew S. Tanenbaum , : Structured Computer Organization , PHI, 4th edition, 1999
2. John L. Hennessy, David Goldberg, David A. Patterson, Computer Architecture : A Quantitative Approach, 2nd Edition Published by Morgan Kaufman Publishers, 1996
3. Silberschatz and Galvin, Operating System Concepts, John Wiley & Sons ,Sixth edition
4. Andrew Tanenbaum, Modern Operating Systems, Pearson Education
5. Milan Milenkovic, "Operating Systems: concepts and design", McGraw-Hill
6. Charles Crowley, "Operating Systems: A Design-Oriented Approach"
7. Dromey, R.G., How to solve it by computers, Prentice Hall, 2005
8. Alfred V.Aho, Ullman, Hopcroft, Data Structures and Algorithms, Addison-wesely.
9. Lipschutz, Seymour & G A V Pai, Data Structures, Tata McGraw – Hill
10. Baldwin, Douglas & Scragg, Greg W., Algorithms and Data Structures The Science of Computing, Dreamtech
11. Kernighan., Ritchie, ANSI C Language, Prentice Hall of India, New Delhi, 1992.
12. Yashwant Kanitker, Let Us C, by Yashwant Kanitker, Second Edition
13. Schaum series, Programming in C, Third Edition
14. Programming Pearls , by Jon Bentley, Pearson Education publication
15. Aho, Alfred V, Compiler Principles, Techniques and Tools, Pearson Education
16. Tharp Alan L, File Organization and Processing, John Willey and Sons
17. Henry F Korth, Abraham Silberschatz, "Database system concepts", Second ed., McGraw-Hill International editions, Computer Science series, 1991
18. Elmasri, Navathe, "Fundamentals of Database Systems", Third ed, Addison Wesley
19. C.J.Date , "An introduction to Database Systems", Sixth ed, Narosa Publications



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	DIGITAL CONTROL OF DYNAMIC SYSTEMS	Credits	4
Sub.Code	12EC5GE1DC	L-T-P	4-0-0

UNIT I

[10 hours]

Review of Continuous Control and Introductory Digital Control

Introduction - Review of Continuous Control - Dynamic Response - Basic Properties of Feedback - Root Locus - Frequency Response Design – Compensation - State-Space Design - **Introductory Digital Control** – Digitization - Effect of Sampling - PID Control

UNIT II

[12 hours]

Discrete System Representation and Analysis

Discrete Systems Analysis - Linear Difference Equations - The Discrete Transfer Function - Discrete Models of Sampled-Data Systems - Signal Analysis and Dynamic Response - Frequency Response - Properties of the z-Transform - **Sampled-Data Systems** - Analysis of the Sample and Hold - Spectrum of a Sampled Signal - Data Extrapolation - Block Diagram Analysis - System Output Between Samples

UNIT III

[10 hours]

Design of Digital Control Systems in Time Domain and Frequency Domain

Discrete Equivalentents - Design via Numerical Integration - Zero-Pole Matching - Hold Equivalentents - **Design Using Transform Techniques** - System Specifications - Design by Emulation - Direct Design by Root Locus in the z-Plane - Frequency Response Methods - Direct Design Method of Ragazzini – Specific case studies

UNIT IV

[10 hours]

Design of Digital Control Systems using State Space Technique

Design Using State-Space Methods - Control Law Design - Estimator Design - Regulator Design: Control + Estimator - Reference Input - Integral Control and Disturbance Estimation - Effects of Delays - Controllability and Observability - Specific



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case studies - **Multivariable and Optimal Control** – Decoupling - Time-varying Optimal Control - LQR Steady-State Optimal Control - Optimal Estimation - Multivariable Control Design – with Examples - Specific case studies

UNIT V

[05 hours]

Quantization effects and parametric sensitivity

Quantization Effects - Analysis of Round-off Errors - Effects of Parameter Round-off - Limit Cycles and Dither - **Sample Rate Selection** - The Sampling Theorem's Limit - Time Response and Smoothness - Errors due to Random Plant Disturbances - Sensitivity to Parameter Variations - Measurement Noise and Antialiasing Filters - Multirate Sampling

TEXT BOOK:

"Digital Control of Dynamic Systems", Gene F. Franklin, J. David Powell and Michael Workman, Addison-Wesley, 3rd Edition, 1998



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	Medical Physics	Credits	4
Sub.Code	12ML5GE1MP	L-T-P	4-0-0

Course Outcomes

- Co1: Understand the principles and applications of heat and cold in medicine
- Co2: Understand the effects of pressure in the body.
- Co3: Understand the physics behind the functioning of lungs and breathing mechanism.
- Co4: Understand the physics of Cardiovascular system and effects of electricity and magnetism on human.
- CO5: Understand the principles of sound and light in medicine

UNIT I

[09 hours]

Heat and Cold in Medicine: Physical Basis of Heat and temperature. Thermometry and Temperature Scales. Thermography-Mapping the Body's temperature. Heat therapy. Use of cold in Medicine. Cryosurgery, safety with Cryogenics

UNIT II

[09 hours]

Energy, Work and Power of the Body: Conservation of Energy in the Body, Energy changes in the body, Work and Power, Heat losses from the Body.

Pressure: Measurement of Pressure in the body, Pressure inside the Skull, Eye Pressure, Pressure in Digestive system, Pressure in the skeleton, Pressure in urinary bladder, Pressure effects while Diving, Hyperbaric Oxygen Therapy (HOT)

UNIT III

[10 hours]

The Physics of the Lungs and Breathing: The Airways, How the blood and lungs interact, Measurement of Lung volumes, Pressure-Airflow-Volume relationships of the Lungs, Physics of alveoli, The breathing mechanism, Airway Resistance, Work of breathing, Physics of some common lung diseases.



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UNIT IV

[12 hours]

Physics of the Cardiovascular System: major components of the Cardiovascular system.

O₂ and C_{o2} exchange in the capillary system, work done by the Heart, Blood Pressure and its Measurement, Pressure across the blood vessel wall (Transmural Pressure), Bernoulli's Principal applied to the cardiovascular system. Blood Flow- Laminar and Turbulent, Heart sounds, the physics of some cardiovascular diseases.

Applications of Electricity and Magnetism in Medicine: Electric shock, High frequency electricity in Medicine, Low frequency electricity and Magnetism in Medicine.

UNIT V

[12 hours]

Sound in Medicine: General properties of sound, the body as a drum, The stethoscope, Ultrasound pictures of the body, Ultrasound to measure motion, Physiological effects of Ultrasound in therapy, The production of Speech (Phonation). The structure of Ear, Sensitivity of Ear, testing your hearing deafness and Hearing aids.

Light in medicine: measurement of visible Light and its units, Application of Visible light in Medicine, Application of Ultraviolet and Infrared light in Medicine, Lasers in Medicine, Application of Microscopes in Medicine. Focussing Elements of the Eye, The structure and functioning elements of the eye, Diffraction effects of the Eye, Optical illusions and related phenomena, Defective vision and its correction, Color vision and Chromatic aberration, Instruments used in Ophthalmology.

TEXT BOOK:

1. MEDICAL PHYSICS - by John R Cameron, James G Skofronick, A Wiley-Interscience Publication.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	DATA STRUCTURES With C++ (Except ML)	Credits	4
Sub.Code	12ML5GE1DS	L-T-P	3-0-1

Course Outcomes

- Co1: Understand the need of Object oriented programming and its relevance in the context of Structures and Functions
- Co2: Learn the concepts and relevance of Classes & Objects
- Co3: Understand the concept of Operator Overloading and inheritance for effective programming.
- Co4: Understand advanced concepts about functions and programming techniques for working with files.
- CO5 : Understand different types of Data structures

UNIT 1

[8 hours]

C++ programming Basics: Need of object oriented programming, procedural languages, characteristics of OOP, preprocessor directives, data types, manipulators. **Structures:** Structures, enumerated data types, Boolean type, **Functions:** passing arguments, returning values, reference arguments, overloaded functions, inline functions, Default arguments, variable and storage classes.

UNIT 2

[4 hours]

Objective: To introduce the fundamentals of Data Structures, Abstract concepts and how these concepts are useful in problem solving. Analyze step by step and develop algorithms to solve real world problems.

Outcome: After completion of this course student will be able to understand the concepts of object oriented language such as C++. Implement various data structures viz. Stacks, Queues Linked Lists, Trees and Graphs. Understand various searching & sorting techniques

UNIT 3

[7hours]

Operator overloading: over loading OF unary operators, binary operators, data conversion. **Inheritance:** Derived class and base class, overriding member functions, scope resolution, class Hierarchies, Public and Private inheritance, levels of inheritance, multiple inheritances.



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UNIT 4

[7 hours]

Functions: Virtual functions, Friend functions, Static functions. **Files and Streams:** Streams, String I/O, Character I/O, Object I/O, I/O with multiple Objects. **Standard Template Library:** Components of STL, Sequence Container: Vector, Iterators.

UNIT 5

[10 hours]

Data structures: Linked list: properties, traversing, insertion, deletion and building a linked list. Implementation of Stacks and Queues as arrays and linked list. Theoretical concepts of Binary Trees and Binary Tree Traversal. Theoretical concept on Recursion, Direct & indirect Recursion, infinite Recursion.

Lab experiments: Lab components must comprise of programs that reinforce the theoretical understanding of the corresponding subject. Programs would address concepts of Structures, Classes, Objects, Operator overloading, Inheritance, Linked List, Stacks and Queues using Array and Linked list.

Text Books:

1. Object oriented programming in TURBO C++, Robert Lafore, Galgotia Publications.2002
2. Data Structures using C++, D.S. Malik, Thomson, 2003.

Reference Books:

1. Object Oriented Programming with C++, E Balaguruswamy, Third edition, TMH2006
2. C++ the complete reference, Herbert Schildt, Fourth edition, TMH, 2003
3. Data Structures, Algorithms and Applications in C++: Sartaj Sahni, Tata McGrawHill Publications.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	Fundamentals of HDL(<i>EE only</i>)	Credits	4
Sub.Code	12EE5GE1HD	L-T-P	3-0-1

UNIT I

[07 hours]

Introduction: Why HDL? , A Brief History of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, simulation and synthesis, Brief comparison of VHDL and Verilog

UNIT II

[08 hours]

Data-Flow Descriptions: Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type – Vectors. **Behavioral Descriptions:** Behavioral Description highlights, structure of HDL behavioral Description, The VHDL variable –Assignment Statement, sequential statements.

UNIT III

[08 hours]

Structural Descriptions: Highlights of structural Description, Organization of the structural Descriptions, Binding, state Machines, Generate, Generic, and Parameter statements

UNIT IV

[08 hours]

Procedures and Functions: Procedures, Tasks, and Functions: Highlights of Procedures, tasks, and Functions, Procedures and tasks, Functions. **Advanced HDL Descriptions:** File Processing, Examples of File Processing.

UNIT V

[08 hours]

Synthesis Basics: Highlights of Synthesis, Synthesis information from Entity and Module, Mapping Process and Always in the Hardware Domain.



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LAB Experiments

Combinational logic circuits, sequential circuits using data flow (simulation and implementing using FPGA/CPLD) sequential descriptions & structural descriptions. Interfacing experiments : stepper motor, dc motor, relay, waveform generation.

TEXT BOOK:

HDL Programming (VHDL and Verilog)- Nazeih M.Botros- Dreamtech Press (Available through John Wiley – India and Thomson Learning), 2006 Edition

REFERENCE BOOKS:

1. **Verilog HDL** –Samir Palnitkar, Pearson Education
2. **VHDL** –Douglas Perry, TMH
3. **Fundamentals of Digital Logic with Verilog Design**-Stephen Brown, TMH
4. **Circuit Design with VHDL**-Volnei A.Pedroni, PHI



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	COMMUNICATION SYSTEMS(EE only)	Credits	4
Sub.Code	12EE5GE1CS	L-T-P	4-0-0

Objectives:

This course provides an understanding of communication theory as applied to the transmission of information bearing signals with equal emphasis and attention given to both analog and digital communication techniques.

UNIT I

[12 hours]

Amplitude modulation: Time-Domain Description, Frequency domain description, Generation of AM waves, Detection of AM waves, AM/DSB, Time-Domain Description, Frequency domain description Generation of DSBSC waves, Coherent Detection of DSBSC Modulated waves. Costas loop, Quadrature Carrier multiplexing, AM-SSB/SC generation, Frequency-Domain Description, Frequency discrimination method for generation an SSB Modulated wave, time domain description, phase discrimination method for generating an SSB modulated wave, Demodulation of SSB waves, Comparison of amplitude modulation techniques, frequency translation, FDM.

UNIT II

[07 hours]

Angle modulation: Basic Concepts, Frequency Modulation, Spectrum Analysis Of sinusoidal FM wave, NBFM, WBFM, Constant Average power, Transmission bandwidth of FM waves, Generation of FM waves, Direct FM, demodulation of FM waves, frequency discriminator, ZCD, phase locked loop (1st order) of AM and FM.

UNIT III

[07 hours]

Noise in Analog modulation systems: Signal-to-noise ratios, AM receiver model, Signal-to - noise ratios for coherent reception, DSBSC receiver, SSB receiver, noise in AM receivers using envelope detection, threshold effect, FM receiver model, noise in FM reception, FM threshold effect, pre-emphasis and de-emphasis in FM systems.

UNIT IV

[12 hours]

Pulse modulation :Sampling theorem for low-pass and band-pass signal, statement and proof, PAM, Channel bandwidth for a PAM signal, natural sampling, flat-top sampling, signal recovery through holding, quantization of signals, quantization error, PCM, electrical representations of binary digits, PCM systems, DPCM, delta Modulation, Adaptive delta modulation.



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UNIT V

[14 hours]

Digital Modulation: Introduction, Binary Shift Keying, DPSK, QPSK, Type D flip-flop, QPSK transmitter, non-offset QPSK, QPSK receiver, signal - space representation, BFSK, spectrum, receiver for BFSK, geometrical representation of orthogonal BFSK, line codes, TDM.

TEXT BOOKS:

1. **"Analog and Digital communication"**, Simon Haykin, John Wiley.
2. **"Principles of communication systems"**, Taub and Schilling, Tata McGraw Hill.

REFERENCE BOOKS:

1. **"Electronic Communication Systems"**, 2nd Edition, Blake, Thomson publishers.
2. **"Electronic Communication Systems"**, George Kennedy.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	FUNDAMENTALS OF VLSI	Credits	4
Sub.Code	10EE6GE2FV	L-T-P	4-0-0

Course Outcomes

CO1: Able to apply the knowledge to describe, compare and derive various types of VLSI technology.

CO2: Identify and design the process of fabrication of various VLSI technologies to meet specified applications.

UNIT I

[06 hours]

A Review of Microelectronics and an Introduction To Mos Technology:

Introduction to integrated circuit technology, Production of E-beam masks. Introduction, VLSI technologies, MOS transistors, fabrication, thermal aspects, production of E-beam masks

UNIT II

[10 hours]

Basic Electrical Properties of Mos an Bicmos Circuit: Drain to source current I_{ds} versus V_{ds} relationships-BICMOS latch up susceptibility. MOS transistor characteristics, figure of merit, pass transistor NMOS and COMS inverters, circuit model, latch up.

UNIT III

[08 hours]

Mos And Bicmos Circuit Design Processes: Mass layers, stick diagrams, design, symbolic diagrams

UNIT IV

[16 hours]

A) Basic Circuit Concepts: Sheet resistance, capacitance layer inverter delays, wiring capacitance, choice of layers.

B) Scaling OfMos Circuits: Scaling model and scaling factors- Limit due to current density.



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UNIT V

[12 hours]

Subsystem Design And Layout , Subsystem Design Processes : Some architecture issues- other systems considerations. Examples of structural design, clocked sequential circuits . Some general considerations, an Illustration of design process, observations.

TEXT BOOKS:

“**Basic VLSI Design**” -3rd Edition, Pucknell Douglas AI , PHI

REFERENCE BOOKS:

1. “Fundamentals of Modern VLSI Devices”-Yuan TaunTak H Ning Cambridge Press, South Asia Edition 2003
2. “ModernVLSI Design Wayne wolf”, Pearson Education Inc. 3rd edition”-Wayne Wolf 2003.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU)

Subject Title	Utilization of Electrical Power	Credits	4
Sub.Code	10EE6GE2UP	L-T-P	4-0-0

Course Outcomes

- Co1: Apply the fundamental knowledge of mathematics and electrical engineering to explain different type's electrical heating gadgets such as ovens and welding equipment.
- Co2: Apply the knowledge of mathematics and science to analyses and estimate power requirements for refining of metals and electroplating.
- Co3: Apply the knowledge of mathematics and science to design lighting systems for different applications.
- Co4: Apply the basic knowledge of engineering to analyze and evaluate electrical performance of traction systems.

UNIT I

[12 hours]

Heating and welding: Advantages and methods of electric of heating, resistance ovens, induction heating, dielectric heating, the arc furnace, heating of building, electric welding, resistance and arc welding, control device and welding equipment.

UNIT II

08 hours]

Electrolytic process: Fundamental principles, extraction, refining of metals, electroplating. Factors affecting electro deposition process, power supply for electrolytic process.

UNIT III

[08 hours]

Illumination: Laws of illumination, lighting calculation, factory lighting, flood lighting, street lighting, different types of lamps, incandescent, fluorescent, vapor and CFL and their working.



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UNIT IV

[12 hours]

Introduction to Electric traction: Systems of traction, speed time curve, tractive effort, co-efficient of adhesions, specific energy, factors affecting specific energy consumption, selection of traction motors.

UNIT V

[12 hours]

Control of Traction Motors: Methods of speed control, energy saving by series parallel control. AC series motor, characteristics, regenerative braking, linear induction motor and their use. Diesel electric equipment, train lighting system.

TEXT BOOKS:

1. J.B.Gupta, **Utilization of Electric Power and Electric Traction**, S.K Kataria and Sons
2. Chakraborty, SoniGupta&Bhatnagar, **A Course in Electrical Power**, DhanpatRai and Sons

REFERENCE BOOK:

Openshaw Taylor, **Utilization of electric energy**, Orient Longman



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	OPERATING SYSTEMS CONCEPTS	Credits	4
Sub.Code	12ES6GE2OS	L-T-P	4-0-0

Course Outcomes

- Co1: Discuss concepts of operating system and abstract views from the developer and user perspective.
- Co2: Analyzing different conceptual and mathematical approach for various scheduling algorithms
- Co3: Understand the concepts of file systems and memory management
- Co4: Exercise different message passing techniques and resource sharing

UNIT I

[10 hours]

INTRODUCTION AND OVERVIEW OF OPERATING SYSTEMS:

Abstract views of an Operating system, Goals of an O.S, Operation of an O.S, Efficiency, system performance and user convenience, Classes of operating systems: O.S and the computer system, Batch processing system, Multi programming systems, Time sharing systems, Real time operating systems, distributed operating systems

UNIT II

[12 hours]

SCHEDULING: Preliminaries, Non-preemptive Scheduling Policies, Preemptive Scheduling Policies, Scheduling practice, Real Time Scheduling, Scheduling in Unix **MEMORY MANAGEMENT:** Static and Dynamic memory allocation, Memory allocation to a process, Reuse of memory, Contiguous memory allocation, Noncontiguous memory allocation, Paging, Segmentation,

UNIT III

[11 hours]

VIRTUAL MEMORY: Virtual memory basics, Demand paging : overview of paging, demand paging preliminaries, page replacement, Page replacement policies, Memory allocation to process, Copy-on-write, UNIX virtual memory.



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FILE SYSTEMS: File system and IOCS, Files and File Operations, Fundamental of File Organizations, Directory Structures, Allocation of disk space, Implementing file access, UNIX file system.

UNIX file system.

UNIT IV

[11 hours]

Message Passing: Overview of message passing, Implementing message passing, Mailboxes, Message passing in Unix

Deadlocks: Definition of deadlock, Deadlock in resource allocation, Handling deadlocks, Deadlock detection and resolution, Deadlock prevention, Deadlock avoidance, Deadlock handling in practice

UNIT V

[08 hours]

STRUCTURE OF THE OPERATING SYSTEMS: Operation of an O.S, Structure of an operating system, Operating system with monolithic structure, layered design of operating system, Virtual machine operating systems, Kernel based operating systems, and Microkernel based operating systems

TEXT BOOK:

“Operating Systems - A Concept based Approach”, D. M. Dhamdhare,
TMH, 2nd Ed, 2006.

REFERENCE BOOKS:

1. **Operating Systems Concepts**, Silberschatz and Galvin, John Wiley, 7th Edition, 2001.
2. **Operating System – Internals and Design Systems**, Willaim Stalling, Pearson Education, 4th Ed, 2006.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	ADVANCED MICROCONTROLLERS & APPLICATIONS	Credits	4
Sub.Code	12ES6GE2MC	L-T-P	3-0-1

Course Outcomes

- Co1: Acquire the knowledge of feature rich ARM and various application processors.
- Co2: Analyze and apply the instruction set of ARM processor in embedded applications
- Co3: Demonstrate optimized ARM code writing and instruction scheduling
- Co4: Recognize the need of firmware, boot- loader , real time operating systems and communication protocols

UNIT I

[08 hours]

Migration from 8051 to 32bit cores, RISC design and ARM Design Approach, Advantages of ARM, ARM Organization, Registers, Current Program Status Registers, 3 stage and 5 Stage Pipeline, Exceptions ,Interrupts and Vector Table, Co processor Interface.

UNIT II

[08 hours]

ARM Instruction Sets, Data Processing Instructions, Branch Instructions, Load Store, Software Interrupt, Program Status Register Instructions, Thumb Instruction Sets; Thumb Register Usage, ARM-Thumb Inter-working, Cross compilers and Optimization, Overview of C compilers and Optimization, Basic C data types, C looping Structures, Function calls., Portability Issues.

UNIT III

[08 hours]

Writing and Optimizing ARM Assembly Code, Writing Assembly Code, Instruction Scheduling, Register Allocation, Looping Constructs, Bit Manipulation, Example Programs.

UNIT IV

[05 hours]

Firmware and Bootloader, Embedded Operating Systems, Memory Management Unit, Working With I2C SPI and USB protocols.



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UNIT V

[10 hours]

Introduction to Intel Atom Architecture

Atom Processor based Platform Overview: IA32 introduction, Platform block diagram, Atom Processor: Addressing Modes, Registers, Memory accesses and memory map, Instruction set, Segmentation, Task switching, Paging, Hyper threading, Caches and TLB, Execution pipeline, x86 legacy features, Interrupts, Intel Atom Micro architecture, Code Optimization.

LAB Experiments

Part-I

Experiment 1 : Interfacing a 7 segment display and working. Experiment 2 : Using GPIOs on Expansion ports Experiment 3 : Write serial communication program in C. Experiment 4 : Interfacing and running PWM drive. Experiment 5: Configuring and working with Audio Codec

1. Introduction to Intel Atom kit
2. Installation of OS
3. Working with GCC Compiler

Part – II

1. Introduction to Intel Atom kit
2. Installation of OS
3. Working with GCC Compiler
4. Interfacing GSM through RS-232
5. Interfacing GPS through RS-232
6. Interfacing RFID through RS-232
7. Interfacing Keyboard and Mouse using USB
8. Recording Video using USB Webcam
6. Interfacing through GPIO

TEXT BOOK:

1. ARM System Developer's Guide By Andrew N Sloss
2. ARM System-On-Chip Architecture By Steve Furber, Addison Wesley, Pearson Education, 2nd edition
3. Experiments on ARM 9 –Practical Guide ,Book By Innovate Software Solutions Pvt Ltd

REFERENCE BOOKS:

1. Jagger (Ed) ARM architectural reference manual, Prentice Hall
2. ARM assembly language an introduction by J. R. Gibson



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	INTRODUCTION TO SPEECH AND AUDIO PROCESSING	Credits	4
Sub.Code	10TC6GE2SA	L-T-P	3-0-1

Objective:

Ability to apply the fundamentals of signal processing for speech and related applications

To emphasize the need for speech analysis and speech synthesis

To design and analyze problems in the area of application of speech enhancement, speech coding and speech recognition

To conduct laboratory experiments applying the concepts of speech processing on a speech/audio sample

UNIT I

[07 hours]

Production and classification of speech sounds: Introduction, mechanism of speech production. Acoustic phonetics: vowels, diphthongs, semivowels, nasals, fricatives, stops and affricates. DSP review. General discrete time model for speech production.

UNIT II

[08 hours]

Time-domain methods for speech processing: Time dependent processing of speech, short-time energy and average magnitude, short-time average zero crossing rate, Speech vs. silence detection, pitch period estimation using parallel processing approach, short-time autocorrelation function.

UNIT III

[08 hours]

Frequency domain methods for speech processing: Introduction, definitions and properties: Fourier transforms interpretation and linear filter interpretation, sampling rates in time and frequency, Filter bank summation and overlap add methods for short-time synthesis of speech, sinusoidal and harmonic plus noise method of analysis/synthesis.

UNIT IV

[08 hours]

Linear predictive coding of speech: Basic principles of linear predictive analysis, Solution of LPC equations, Prediction error signal, Frequency domain interpretation, Relation between the various speech parameters, Synthesis of speech from linear predictive parameters, Applications



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UNIT V

[08 hours]

Homomorphic speech processing: Introduction, Homomorphic systems for convolution, the complex cepstrum of speech, pitch detection, formant estimation. The homomorphic vocoder

Lab Experiments:

Basic audio experiments, Time domain methods, frequency domain based estimation, speech synthesis

Mini-project

TEXT BOOKS:

1. **Digital processing of speech signals** – L. R. Rabiner and R. W. Schafer, Pearson Education Asia, 2004. **Fundamentals of Multimedia** – Z. Li and M.S. Drew, Pearson Education Ltd., 2004.

REFERENCE BOOKS:

1. **Discrete time speech signal processing**– T. F. Quatieri, Pearson Education Asia, 2004.
2. **Speech and audio signal processing: processing and perception of speech and music**– B. Gold and N. Morgan, John Wiley, 2004.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	OBJECT ORIENTED PROGRAMMING USING C++ AND JAVA <i>Not for those who have taken 12ES5GE1OP</i>	Credits	4
Sub.Code	12TC6GE2CJ	L-T-P	4-0-0

Objective:

Ability to apply the concepts of Object Oriented Programming with emphasis on C++

Ability to design and analyze real life applications by writing efficient programs to implement various modules considering constraints such as memory and portability.

Emphasize the importance of Classes, Objects, Data Abstraction, Data encapsulation, Overloading, Inheritance, Polymorphism and Reusability

Impart education to understand the need for life-long learning in the area of software engineering/programming

UNIT I

[10 hours]

Functions in C++: Function prototype, argument passing, recursion, inline functions, friend and virtual functions
Classes and objects: Class definition and declaration, member functions, static data members and member functions, arrays of objects, returning objects

UNIT II

[10 hours]

Constructors and destructors: Constructors, parameterized constructors, multiple constructors in a class, copy constructor, dynamic constructors, and destructors. Operator overloading and type conversions: Overloading unary and binary operators, overloading using friends, rules for overloading.

UNIT III

[10 hours]

Inheritance: Inheritance, public, private and protected inheritance. Private member inheritance. Types of inheritance: Single, Multilevel, multiple, hierarchical, hybrid. Pointers, virtual functions and polymorphism. Pointers, pointers to objects, this pointer, pointers to derived classes, virtual functions. Constructors in derived class. Managing console I/O operations: C++ streams, C++ stream classes, I/O operations, managing O/P with manipulators.



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UNIT IV

[12 hours]

Templates: Class templates, function templates, overloading template functions, member function templates and non type template arguments. Exception handling: Basics, throwing and catching mechanisms, rethrowing an exception, specifying exceptions.

UNIT V

[10 hours]

Introduction Object Oriented Programming using Java – Object Oriented Concepts – Abstraction & Encapsulation – Relationships – Polymorphism – Interfaces and Packages

TEXT BOOKS:

1. **Object oriented Programming with C++**, -E Balagurusamy (TMH Publications, 4th edn)
2. **Object oriented Programming in turbo C++**, Robert Lafore (GALGOTIA Publications)

REFERENCE BOOK:

- 1 **Let Us C++**--Yashavanth P. Kanetkar (BPB Publications)
Programming With C++-----Schaum'sseries (TMH Publications)
- 2 **Programming With C++**-----Schaum'sseries (TMH Publications)



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	BIOSENSORS	Credits	4
Sub.Code	10ML6GE2SN	L-T-P	4-0-0

Course Outcomes:

- Co1: Learn the concepts of biosensors and its types used in health care industry and Clinicolaboratories.
- Co2: Learn the concepts of transducers used for biosensor applications
- Co3: Know the applications and uses of Biosensors in medicine and healthcare
- Co4: Understandthe usage of semiconductor electrodes in biosensors
- Co5: Learn the assay techniques used in biosensors

UNIT I

10 hours]

Introduction: Introduction to Biosensors. Advantages and limitations, various components of biosensors, the growing of biosensor.The biosensor family, the biomolecule ingredients, proteins, enzymes complexes, enzymes kinetics, the proteins of the immune systems.

UNIT II

[10 hours]

Transducers in biosensors: Various types of transducers, principles and applications - Calorimetric, optical, potentiometric / amperometric, conductrometric/resistormetric, piezoelectric, semiconductor, impedimetric, mechanical and molecular electronics based transducers. Chemiluminescences - based biosensors.

UNIT III

10 hours]

Application and uses of biosensors: Biosensors in clinical chemistry, medicine and health care, biosensors for veterinary, agriculture and food. Biosensors for personal diabetes management, application of biosensors to environmental samples. Biochips and their application to genomics.

UNIT IV

[12 hours]

Semiconductor electrodes: Measurement of H^+ , Ion selective interfaces, Ion selective electrodes, semiconductor electrodes, MIS structures, semiconductor solution interface, FET,



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chemical sensitive FETA (CHEMFETA), suspended gate field effect transistor, selectivity via pattern recognition, Ion selective FET (ISFET), reference FET, CHEMFET, assessment of CHEMFETS.

UNIT V

[10 hours]

Photometric assay techniques: Energy transition, ultraviolet and visible absorption spectra, fluorescence and phosphorescence, infra Red transitions, light scattering, Raman scattering, applications of ultraviolet visible spectra, indicator linked bioassay, irrational spectroscopy, the optical transducer, wave guides in sensors, device construction, PH optical probes, light scattering analysis.

TEXT BOOKS:

1. **Biosensors** by Elizabeth A. Hall - Open University press, Milton Keynes.
2. **Commercial Biosensors** by Graham Ramsay, John Wiley and son, INC. (1998).

REFERENCE BOOKS:

1. **Biosensors** by Eggins
2. **Biosensors** edited by AEG CASS – OIRL press, Oxford University.
3. **Transducers and Instrumentation** by Murthy D V S. Prentice Hall, 1995



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU)

Subject Title	BIOSTATISTICS	Credits	4
Sub.Code	12ML6GE2BS	L-T-P	4-0-0

Course Outcomes

- Co1: Construct the most suitable basis that simplifies the solution of a problem and develop the best method for probability and predictability.
- Co2: Use the concept of Biostatistics to simplify the data aspect to solve problems
- Co3: Understand concepts of Distributions for simplification of usage to analyze biomedical/biological data
- Co4: Use current techniques, skills necessary for computing practice.
- Co5: Design and evaluate a given problem and test the correctness of the analysis.

UNIT I

[8 hours]

Introduction to Biostatistics: Introduction, Some basic concepts, Measurement and Measurement Scales, Simple random sample.

Descriptive Statistics: Introduction, Ordered array, Grouped data-frequency distribution, Descriptive statistics- measure of central tendency, Measure of dispersion, measure of central tendency computed from grouped data, variance and standard deviation-grouped data

UNIT II

[10 hours]

Basic probability Concepts: Introduction, Two views of probability – Objective and Subjective, Elementary properties of Probability, Calculating the probability of an event, Bayes's Theorem, Screening Tests, Sensitivity, Specificity and Predictive Value Positive and Negative.

Probability distribution: Introduction, Probability distribution of discrete variables, binomial distribution, Poisson distribution, Continuous probability distribution, Normal distribution and applications.

Sampling distribution: Introduction, Sampling distribution, Distribution of the sample mean, Distribution of the difference between two sample means, Distribution of the sample proportion, Distribution of the difference between two sample proportions.



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UNIT III

[10 hours]

Estimation: Introduction, Confidence interval for population mean, t-distribution, Confidence interval for difference between two population means, Population proportion and difference between two population proportions, determination of sample size for estimating means and proportions, confidence interval for the variance of normally distributed population and ratio of the variances of two normally distributed populations.

UNIT IV

[12 hours]

Hypothesis Testing: Introduction, Hypothesis testing – Single population mean difference between two population means, paired comparisons, hypothesis testing – single population proportions, single population variance, ratio of two population variance.
Comparison of Means by three or more Samples (ANOVA) – Technique of Analysing Variance, Procedure for calculation of F-Statistic, ANOVA for one way classification, ANOVA for one way classification for samples of unequal size, ANOVA for two way classification, F-Analysis by coding method, Missing data formulation technique for Analysis of Variance.

UNIT V

[12 hours]

Linear Regression and Correlation: Introduction, Regression model, Sample Regression equation, Evaluating the regression equation, Using the regression equation, Correlation model, Correlation coefficient, Some Precautions. **Chi-square Test:** Introduction, Characteristics, Assumptions for validity, Applications of Chi-Square test: Goodness of fit, Test of Independence, Test of Homogeneity.

TEXT BOOK:

1. **BIostatISTICS**-A Foundation for analysis in the Health Sciences by Warne W Daniel, 7th Edition, John Wiley & Sons Publication.
2. **Fundamentals of Biostatistics** by Khan and Khanum, 2nd Edition, Ukaaz Publications, 2004.

REFERENCE BOOKS:

1. **Principles of Biostatistics** – by Marcello Pagano and Kimberlee Gauvreu, Thomson Learning Publication, 2006
2. **Introduction to Biostatistics** – by Ronald N Forthofer and Eun Sul Lee, Academic Press, 1995.
3. **Basic Biostatistics and its Applications** – by Animesh K Dutta, New Central Book Agency, 2006.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	BIOMEDICAL DSP	Credits	4
Sub.Code	10IT6GE2MD(Except ML)	L-T-P	3-0-1

Objective

Examining the full scope of digital signal processing in the biomedical field, this course provides the basics of digital signal processing as well as programming in MATLAB for designing and implementing digital filters for biomedical application. It provides a set of laboratory experiments that can be done using either an actual analog-to-digital converter, or taking the available data base to process the biomedical signals. The course emphasizes on feature extraction and classification of normal and abnormal features using different modeling techniques.

UNIT I

[10 hours]

INTRODUCTION TO BIOMEDICAL SIGNALS

The nature of biomedical signals, the action potential, objectives of biomedical signal analysis, Difficulties in biomedical signal analysis, computer aided diagnosis. Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG parameters and their estimation, The use of multi- scale analysis for parameter estimation of ECG waveforms, Arrhythmia analysis monitoring, long term continuous ECG recording, Neurological Signal Analysis The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics, EEG analysis.

UNIT II

[07 hours]

Cardiological Signal Processing:

Adaptive Interference/Noise Cancellation, A review of Wiener filtering problem, Principle of an Adaptive filter, The steepest-descent algorithm, the Widrow-Hoff least mean square adaptive algorithm, Adaptive noise canceller, Cancellation of 60Hz interference in ECG, Canceling

Donor-heart interference in Heart-transplant electrocardiography, Cancellation of ECG signal from the electrical activity of the chest muscles, canceling of maternal ECG in fetal ECG, Cancellation of High frequency noise in Electro-surgery.



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UNIT III

[06 hours]

ECG Data Reduction Techniques

Direct data compression techniques, Direct ECG data compression techniques, Transformation compression techniques, Transformation compression techniques, other data compression techniques, Data compression techniques comparison.

UNIT IV

[06 hours]

LINEAR PREDICTION THEORY

The Autoregressive (AR) method, Recursive estimation of AR parameters, Spectral error measure, Adaptive segmentation, Transient detection and elimination- the case of epileptic patients, overall performance. Sleep EEG. Data acquisition and classification of sleep stages, The Markov model and Markov chains, Dynamics of sleep-wake transitions, Hypnogram model parameters, Event history analysis for modeling sleep

UNIT V

[08 hours]

Prony's Method:

Exponential modeling, Exponential parameter estimation, The original Prony problem, Least squares Prony method, The covariance method of linear prediction, Prony's method in the presence of noise, clinical application of Prony's method.

Simulation EXPERIMENTS:

FIR filter Design, iir filter design , implementing Pan Tompkins algorithm, adaptive filters for cancelling different noise in ecg, AR prediction , Time frequency analysis for biomedical signals.

TEXT BOOKS:

1. "Biomedical Signal Processing Principles and Techniques", by D C Reddy, The McGraw-Hill publications.
2. "Biomedical Signal Analysis a case study approaches", by Rangaraj M. Rangayyan The John Wiley publications

REFERENCE BOOK:

"Biomedical Digital Signal Processing", Willis J. Tompkins, The Prentice Hall of India publications.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU)

Subject Title	MEMS TECHNOGY	Credits	4
Sub.Code	12IT6GE2MT	L-T-P	4-0-0

UNIT I

[12 hours]

MEMS: MICRO-FABRICATION, MATERIALS AND ELECTRO- MECHANICAL CONCEPTS

Overview of micro fabrication – Silicon and other material based fabrication processes –

Concepts: Conductivity of semiconductors-Crystal planes and orientation-stress and strain- flexural beam bending analysis-torsional deflections-Intrinsic stress- resonant frequency and quality factor.

UNIT II

[08 hours]

ELECTROSTATIC SENSORS AND ACTUATION

Principle, material, design and fabrication of parallel plate capacitors as electrostatic sensors and actuators-Applications

UNIT III

[10 hours]

THERMAL SENSING AND ACTUATION

Principle, material, design and fabrication of thermal couples, thermal bimorph sensors, thermal resistor sensors-Applications.

UNIT IV

[10 hours]

PIEZOELECTRIC SENSING AND ACTUATION

Piezoelectric effect-cantilever piezo electric actuator model-properties of piezoelectric materials- Applications



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UNIT V

[12 hours]

CASE STUDIES

Piezoresistive sensors, Magnetic actuation, Micro fluidics applications, Medical applications, Optical MEMS, Introduction to NEMS.

REFERENCE BOOKS:

1. Chang Liu, "Foundations of MEMS", Pearson International Edition, 2006.
2. Marc Madou , "Fundamentals of microfabrication",CRC Press, 1997.
3. Boston , "Micromachined Transducers Sourcebook",WCB McGraw Hill, 1998.
- 4.M.H.Bao "Micromechanical transducers :Pressure sensors, accelerometers and gyroscopes", Elsevier, Newyork, 2000.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	EMBEDDED SYSTEM DESIGN	Credits	4
Sub.Code	12EE6GE3ED	L-T-P	4-0-0

Objectives:

Create an environment for the systematic and effective application of scientific principles to the efficient design and operation of computer-based structures, processes and systems.

Create a setting where students can identify deficiencies or weaknesses in an existing solution and try novel ideas to improve it.

Indulge the concept where the task of design is fundamental and central.

Prepare educational materials that have a great deal of content, while at same time teaching students to think and discover for themselves.

Further enhancement of this subject for students will be in the field of Robotics, navigation, missile, satellite launching, wireless communication, instrumentation controls and defense applications from which students are benefitted to the greater extent and they will be convinced that this subject plays a vital role for the future scope.

UNIT I

[12 hours]

Concept of embedded system design: Internal Block Diagram, Components, classification, skills required. Embedded Micro controller cores: Features, Architecture and block diagram of Motorola Controller (6808 or 6811). Embedded Memories ROM variants, RAM, Applications of **embedded system:** Examples of Embedded systems, SOC for cellular phones, Smart cards, etc.

UNIT II

[09 hours]

Technical aspects of Embedded System: Interfacing between analog and digital blocks, Signal conditioning, digital signal processing, DAC & ADC interfacing, various signal conditioning circuits using DSP or Motorola Controller.

UNIT III

[10 hours]

Interfacing Concepts: Sample & hold, multiplexer interface, Internal ADC interfacing with DSP or Motorola Controller, Data Acquisition System and Signal processing circuits, criteria in the selection of embedded system design, Design challenge, design technology, Software aspects of Embedded Systems.



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UNIT IV

[11 hours]

Software Design: Real time programming Languages, operating systems. Programming concepts and embedded programming in C, Scheduling algorithms such as Round Robin, Round Robin with interrupts, priority, pre-emptive, function queue-scheduling architecture, Real time OS architecture, and selection

UNIT V

[10 hours]

Peripheral Interfacing: Introduction to RTOS, Subsystem interfacing with external systems such as, Serial I/O devices, Parallel port interfaces, Input switches, Key boards and Memory interfacing. 10 Hours

TEXT BOOKS:

1. "**Embedded Microcomputer systems:** Real time interfacing"- Valvano, J.W, Brooks/Cole, 2000
2. "**Embedded System, Architecture, Programming and Design**"- Raj Kamal TMH 2003.

REFERENCE BOOKS:

1. "**A Unified Hardware/Software Introduction**"-Frank Vahid/Tony Givargis, Wiley student edition 2002
2. Jane W.S., Liu, "**Real time systems**", Pearson Education Asia Pub, 2004.
3. Motorola and Intel Manuals



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	ELECTRONIC INSTRUMENTATION(EE only)	Credits	4
Sub.Code	10EE6GE3EI	L-T-P	4-0-0

Course Outcomes:

Co1: To distinguish and understand the various analog and electronic instruments.

CO2: To apply the knowledge to select the transducer depending upon the application

CO3: To comprehend the working of electrical and electronic instrumentation system.

UNIT I

[11 hours]

Electric instruments for measuring basic parameters: Introduction, amplified DC meter, AC voltmeter using rectifiers, electronic multi meter, considerations in choosing an analog voltmeter, Q meter.

UNIT II

[10 hours]

Strip Chart Recorders, Galvanometer type, Null type, X-Y recorders

Standard Signal Generator, AF sine and square wave generator, function generator, square and pulse generator .(block diagram description)

UNIT III

[11 hours]

Transducers: classification of transducers, selecting a transducer, potentiometric transducer, LVDT, strain gauges types, Piezo electric transducers, problems.

UNIT IV

[10 hours]

Field Strength Meter, Stroboscope Phase meter, Direct reading Impedance meter, LC bridge, R-X meter

UNIT V

[10 hours]

Instrumentation Systems, interfacing transducers to electronic control and measuring systems, multiplexing.

TEXT BOOKS:

- Modern Electronic Instrumentation and Measurement Techniques**, Albert.D.Helfrick, William.D.Cooper, 3/e Pearson, PHI.
- Electronic Instrumentation**, H.S. Kalsi, TMH.

REFERENCE BOOK:

A course in Electrical and Electronic Measurements and Instrumentation, A.K. Sawhney, 18th Edition, DhanpatRai and Co., New Delhi.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	RENEWABLE ENERGY RESOURCES	Credits	4
Sub.Code	10EE6GE3RE	L-T-P	4-0-0

Course Outcomes

- CO1: Ability to apply engineering fundamentals to analyses and solve engineering problems with a focus to meet the increasing energy demand.
- CO2: Ability to identify and organize processes having higher priority for and environmental considerations.
- CO3: Ability to understand the impact of the professional engineering problems in environmental contexts and demonstrate the need for sustainable development.

UNIT I

[13 hours]

Introduction to energy sources, need for non-conventional energy sources

SOLAR ENERGY: Introduction, extra-terrestrial and terrestrial solar radiation, Solar Constant, Basic Sun-Earth Angles – definitions and their representation, Solar Radiation Geometry (numerical problems), Estimation of Solar Radiation of Horizontal and Tilted Surfaces (numerical problems); Measurement of Solar Radiation Data – Pyranometer and Pyrheliometer.

SOLAR- ELECTRIC CONVERSION SYSTEM: solar energy collection ,thermal energy transfer, thermal energy storage, energy conversion

Solar Thermal Systems: Solar Water Heaters (Flat Plate Collectors), Solar Cookers – Box type, concentrating dish type, Solar driers, Solar Still, Solar Furnaces, Solar Green Houses.

UNIT II

[07 hours]

Solar Electric Systems: Solar Thermal Electric Power Generation – Solar Pond and Concentrating Solar Collector (parabolic trough, parabolic dish, Central Tower Collector). Advantages and Disadvantages; Solar Photovoltaic – Solar Cell fundamentals,



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characteristics, classification, construction of module, panel and array. Photo-voltaic energy storage, Solar PV Systems – stand-alone and grid connected; Applications – Street lighting, Domestic lighting and Solar Water pumping systems. Central receiver systems, the Heliostats, satellite solar power systems.

UNIT III

[09 hours]

Wind energy: Introduction, principles of wind power, wind turbine operation, site characteristics, variation of power output with wind speed, new developments: small machines, large machines.

UNIT IV

[12 hours]

Energy from oceans: Introduction, ocean temperature differences, the open or Claude cycle, modification of the open OTEC cycle, the closed or Anderson cycle, OTEC cycle, ocean waves, wave motion, energy and power from waves, wave-energy conversion by floats, high pressure accumulation wave machines, the tides, the simple single-pool tidal system, the modified single-pool tidal system, the two-pool tidal system biofouling, Advantages & Limitation of OTEC. **GEOTHERMAL ENERGY:** Introduction, origin and types of geothermal energy, operational and environmental problems, vapor dominated systems, liquid dominated systems, (flashed steam, binary cycle, total flow concept)

UNIT V

[11 hours]

Energy storage: Energy storage systems, pumped hydro, compressed air storage, energy

storage by (i) flywheels (ii) electrical battery (iii) super conducting magnet, (iv) latent heat (v) chemical reaction (vi) thermal sensing.

Emerging Technologies: Fuel Cell, Small Hydro Resources, Magneto Hydro Dynamic Generation, Hydrogen Energy, (Principle of Energy generation using block diagrams, advantages and limitations).

TEXT BOOK:

“**Non-Conventional Sources of Energy**”- 4th Edition, G.D.Rai, Khanna Publishers, New Delhi, 2007

REFERENCE BOOKS:

1. “**Generation of electrical Energy**”-B.R.Gupta-S.Chand& Company Ltd
2. “**Non-Conventional Energy Resources**”- Khan, B. H., TMH, New Delhi, 2006.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	REAL TIME EMBEDDED SYSTEMS	Credits	4
Sub.Code	10TC6GE3RT	L-T-P	4-0-0

Objective

ability to apply knowledge of simple Mathematics like probability and Science in Telecommunication Engineering

ability to analyze computer controlled system operations & its application in a field Electronics and Communication (embedded system)

ability to identify the real time application and analyze its benefits in Electronics Engineering

recognize the need for real time systems in communication engineering and pursue life-long learning in it

UNIT I

[10 hours]

INTRODUCTION TO REAL-TIME SYSTEMS: Definition of Real Embedded Systems, RTS Definition, Classification of Real-time Systems, Time constraints, applications, basic model, Characteristics, Classification of Real-time Systems, safety and reliability. modeling time constraints.

UNIT II

[11 hours]

REAL TIME OPERATING SYSTEM CONCEPTS- features of RTOS, architecture of the kernel, tasks and task scheduler, task states, context switching, classification of task scheduling algorithm, clock driven scheduling, hybrid scheduler, event driven scheduling, Earliest Deadline First (EDF) scheduling, Rate Monotonic Algorithm(RMA)

UNIT III

[11 hours]

HANDLING RESOURCE SHARING AND DEPENDENCIES AMONG REAL TIME TASKS: resource sharing among real time tasks, assigning priorities, Priority Structures, priority inversion, critical region, semaphores, shared data, signals, message queues, mailboxes, pipes, timers, memory management

UNIT IV

[10 hours]

REAL TIME COMMUNICATION: I/O devices, timer & counting devices; watchdog timer, real time clock, serial communication protocols- I²C, CAN, USB buses, IEEE 1394 - Firewire; parallel communication protocols-ISA, PCI and PCI/X buses, ARM

UNIT V

[10 hours]



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SURVEY OF COMMERCIAL RTOS AND CASE STUDIES: Windows asRTOS(Windows CE), RTLinux, POSIX, VXworks, MicroC/OS II, case study of digital camera hardware and software architecture, case study of an embedded system for automobile

TEXT BOOK:

1. **Embedded Systems Architecture; Programming and Design** - Rajkamal;second edition, Tata McGraw Hill Publications.
2. **Real-time computer control – An Introduction** – Stuart Bennet, 2nd Edn. PearsonEducation. 2005
3. **Embedded /real time Systems: concept, design & programming** - DR K.V.K.K. Prasad-dream tech press

REFERENCE BOOKS:

1. **An Embedded software primer**-David E Simon; Addison Wesley; 2000
2. **Real-Time Systems Design and Analysis**--3rd Edition, Phillip A. Laplante. Apr 2004. Wiley-IEEE Press.
3. **An Introduction to Real Time Systems**-Raymond J.A. Buhr; Donald L. Bailey; Prentice Hall International; 1999.
4. **“A Unified Hardware/Software Introduction”**-Frank Vahid/Tony Givargis, Wiley student edition 2002 .



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Subject Title	AUTOMOTIVE EMBEDDED SYSTEMS DEVELOPMENT TECHNOLOGY	Credits	4
Sub.Code	12ES6GE3AE	L-T-P	4-0-0

UNIT I

[10 hours]

Powertrain systems-Introduction to Automotive systems-Engine Management System, Transmission system-front, rear and 4-way drive, Manual/ Automatic transmission, Differential system

UNIT II

[10 hours]

Sensors and Actuators-Classification of sensors, Pressure sensors, Linear and Angle position sensors, flow sensors, Temperature, Heat and Humidity sensors, speed and acceleration sensors, exhaust Gas sensors, Actuators-types of Electromechanical

Actuators, Automotive Actuators, fluid mechanical actuators.

UNIT III

[10 hours]

Body electronics-Comfort and Safety oriented Automotive Subsystems, Requirements, Modeling/Design of Automotive Body Electronics (Night Vision, Power windows, Power mirrors, Power Seat, Seatbelt Tensioners, Airbag, Cruise control, Lane departure warning, parking), Simulation based case studies.

UNIT IV

[10 hours]

Embedded System Communication Protocols- Introduction to control networking – Communication protocols in embedded systems – SPI, I2C, USB – Vehicle communication protocols – Introduction to CAN, LIN, FLEXRAY, MOST, KWP2000, IDB1394



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UNIT V

[12 hours]

Automotive System Development- Model based development of Automotive grade ECUs, AUTOSAR development standards, Value Engineering, Fundamentals of safety and hazard analysis (ISO26262), Fault diagnosis of automotive subsystem, SPICE Development standards, EMI-EMC consideration, overview of calibration development support subsystem

TEXT BOOK:

1. "Automotive Electrics Automotive Electronics", 5th edition, Robert Bosch GmbH, Wiley publications.
2. "Automotive Electronics Handbook", Ronald K Jurgen, McGraw-Hill, Inc, 2nd edition.
3. "Automotive Embedded Systems Handbook", Nicolas Navet, Industrial Information Technology Series, CRC press.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	FUNDAMENTALS OF IMAGE PROCESSING (EXCEPT ML)	Credits	4
Sub.Code	12ES6GE3IP	L-T-P	3-0-1

Course Outcomes

- CO1: Acquire knowledge of fundamentals of an image processing system.
- CO2: Analyze, apply and implement various image enhancement techniques in spatial domain and frequency domain
- CO3: Analyze and apply image restoration and image transform techniques.
- CO4: Visualize and experiment color fundamentals of an image

UNIT I

[07 hours]

Introduction to Image Processing: Introduction, Fundamental steps in DIP, Components of DIP system, A simple image formation model, Image sampling and quantization, Basic relationship between pixels, Arithmetic and Logical operations on images, Image file formats

UNIT II

[08 hours]

Image Enhancement in Spatial Domain: Background, Point processing – Image negatives, Log transformations, Power law transformations, Contrast stretching, Gray level slicing, Bit plane slicing, Histogram processing – Histogram equalization, Local enhancement.

UNIT III

[08 hours]

Image Enhancement in Frequency Domain: Background, Basic properties of the frequency domain, Basic filtering in the frequency domain, Basic filters and their properties, Smoothing frequency domain filters – Ideal lowpass filters, Butterworth lowpass filters, Gaussian lowpass filters, Sharpening frequency domain filters – Ideal highpass filters, Butterworth highpass filters, Gaussian highpass filters, Frequency domain filters, Homomorphic filtering.



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UNIT IV

[08 hours]

Image Restoration: Image degradation/restoration model, Inverse filter, Pseudo Inverse filter, Noise models, Restoration using spatial filtering – Mean filters, Geometric mean filters, Harmonic mean filters, Median filter, Max & min filters, Midpoint filter, Wiener filter, Constrained Least squares filter.

UNIT V

[08 hours]

Color Image Processing: Fundamentals of color image processing, Color models, Conversion of color models from one form to other form, Pseudo color image processing, Full color image processing, Color Image Quantization, Histogram of color Image.

Basic Image Transforms: Two-dimensional orthogonal unitary transforms, Properties of Unitary Transforms, K-L Transform.

Lab Experiments to be conducted using MATLAB:

1. Negative of an image
2. Arithmetic and Logical Operations on an image
3. Average of an image, Zooming and Pixel replication of an image
4. Bit – plane slicing of an image
5. Power – law transformation and Logarithmic transformation of an image
6. Histogram equalization and Contrast enhancement of an image
7. Basic transformation of an image
8. Gray level slicing of an image (With and Without Background Preservation)
9. Butterworth Low Pass and High Pass filters
10. Gaussian Low Pass and High Pass filters.
11. Inverse Filter and Pseudo Inverse filter.
12. Wiener filter.
13. Color Median filter
14. Color histogram equalization
15. Pseudo – color image processing

TEXT BOOK:

Digital Image Processing by Rafael C. Gonzalez & Richard E. Woods, Third Edition, Pearson education, 2009.

REFERENCE BOOKS:

Digital Image Processing by S.Jayaraman, S.Esakkirajan, T.Veerakumar, TMH, 2009.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	DESIGN OF ANALOG AND MIXED MODE VLSI CIRCUITS(ONLY TC)	Credits	4
Sub.Code	10TC6GE3MM	L-T-P	4-0-0

Objective:

This course deals with the analysis and design of analog CMOS integrated circuits, emphasizing fundamentals as well as new paradigms. The objective is to develop both a solid foundation and methods of analyzing circuits by inspection so that the student learns what approximations can be made in which circuits and how much error to expect in each approximation.

UNIT I

[10 hours]

Introduction to CMOS analog circuits

Basic MOS Device Physics: General considerations, MOS I/V Characteristics, second order effects, MOS device models.

UNIT II

[10 hours]

Single stage Amplifier: CS stage with resistance load, divide connected load, current source load, triode load, CS stage with source degeneration, source follower, common-gate stage, cascade stage, choice of device models.

Differential Amplifiers: Basic difference pair, common mode response, Differential pair with MOS loads, Gilbert cell.

UNIT III

[10 hours]

Operational Amplifiers: One Stage OP-Amp. Two Stage OP-Amp, Gain boosting, Common Mode Feedback, Slew rate, PSRR. Compensation of 2stage OP-Amp, Other compensation techniques

UNIT IV

[10 hours]

Data converter fundamentals: Analog versus Digital Discrete Time Signals, Converting Analog Signals to Data Signals, Sample and Hold Characteristics, DAC Specifications, ADC Specifications, Mixed-Signal Layout Issues.



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UNIT V

[12 hours]

Data Converters Architectures: DAC Architectures, Digital Input Code, Resistors String, R-2R Ladder Networks, ADC Architectures, Flash, 2-Step Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC.

TEXT BOOKS:

1. **Design of Analog CMOS Integrated Circuits**, B Razavi, First Edition, McGraw Hill, 20012.
2. **Design, Layout, Stimulation**, R. Jacob Baker, Harry W Li, David E Boyce, CMOS Circuit, PHI Education, 2005

REFERENCE BOOKS

CMOS Analog circuit Design Phillip. E. Allen, Douglas R. Holberg, Oxford University Press, 2002



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Subject Title	BIOMEDICAL CIRCUITS WITH VLSI	Credits	4
Sub.Code	12ML6GE3BC	L-T-P	4-0-0

Course Outcomes

- Co1: Understand the basics of MOSFET operation.
- Co2: Understand the fundamental concepts in fabrication of CMOS integrated circuits.
- Co3: Understand the operation of different Complex logic circuits.
- Co4: Learn logic gate as a switch and transmission gate for designing FET-arrays.
- CO5: Learn the applications of CMOS circuits for biomedical devices.

UNIT I

[09 hours]

An Overview of VLSI: Complexity and design. Basic concepts, Physical structure CMOS integrated circuits: Integrated circuit layers, MOSFETS.

UNIT II

[10 hours]

Ideal switches and Boolean operation, MOSFETS and switches, Basic logic gates in CMOS, Complex logic gates in CMOS, Transmission gate circuits, CMOS layers, Designing FET array.

UNIT III

[10 hours]

Electronic analysis of CMOS Logic gates, DC characteristics of the CMOS Inverter, Inverter Switching characteristics, Power dissipation, DC characteristics of NAND and NOR gates, NAND and NOR transient response, Analysis of complex logic gates, Gate design for transient performance.

UNIT IV

[9 hours]

Fabrication of CMOS integrated circuits, Overview of silicon processing, material growth and deposition, lithography, CMOS process flow

UNIT V

[14 hours]

CMOS Circuits for Biomedical Implantable Devices: Introduction, Inductive Link to Deliver Power to Implants, High Data rate Transmission Through Inductive links, Energy



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and Bandwidth Issues in Multi –Channel Biopotential Recordings. Self-Powered Sensors and circuits for biomechanical Implants: Introduction, Fundamentals of Piezoelectric Transduction and power Delivery. CMOS Circuits for Wireless Medical Applications: Introduction, Spectrum Regulations for Medical use, Integrated Receiver Architecture, Integrated Transmitter Architecture, Radio Architecture selection, System Budget calculations, Low noise Amplifier, Mixers, Polyphase Filter, Power Amplifier, PL

TEXT BOOKS:

1. JOHN P. UYEMURA, John Wiley , “**Introduction to VLSI circuits and systems**”, Wiley 2001 edition. For Unit:1, 2,3.
2. Krzysztof Iniewski “ **VLSI circuits for Biomedical Applications**” Artech House 2008 edition. For Unit 4 and 5.

REFERENCE BOOK:

Douglas A. Pucknell and Kamran Eshranghian, “**Basic VLSI Design**”, PHI third edition, 2005.

Question Paper Pattern:Internal Choice in **Unit 4** and **Unit 5**



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	REHABILITATION ENGINEERING	Credits	4
Sub.Code	10ML6GE3RE	L-T-P	4-0-0

Objective:

To describe the role of occupational/physical/speech therapy, rehabilitation psychology and the multidisciplinary rehabilitation team in treating disabled patients in acute and chronic care settings. To comprehend rehabilitation framework of disease, functional impairment, activity limitation and barriers to social participation in approaching neurologic problems.

UNIT I

[12 hours]

Introduction to Rehabilitation & Rehabilitation Team: What is Rehabilitation, Epidemiology of Rehabilitation, Health, Levels of Prevention, Preventive Rehabilitation, Diagnosis of Disability, Functional Diagnosis, Importance of Psychiatry in Functional diagnosis, Impairment disability handicap, Primary & secondary Disabilities, Effects of prolonged inactivity & Bed rest on body system.

Rehabilitation Team: Classification of members, The Role of Physiatrist, Occupational therapist, Physical therapist, Recreation therapist, Prosthetist-Orthotist, Speech pathologist, Rehabilitation nurse, Social worker, Corrective therapist, Psychologist, Music therapist, Dance therapist & Biomedical engineer.

UNIT II

[10 hours]

Therapeutic Exercise Technique

Co-ordination exercises, Frenkels exercises, Gait analyses-Pathological Gaits, Gait Training, Relaxation exercises-Methods for training Relaxation, Strengthening exercises-Strength training, Types of Contraction, Mobilisation exercises, Endurance exercises.

UNIT III

[10 hours]

Principles in Management of Communication

Impairment-introduction to communication, Aphasia, Types of aphasia, Treatment of aphasic patient, Augmentative communication-general form of communication, types of visual aids, Hearing aids, Types of conventional hearing aid, Writing aids.



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UNIT IV

[10 hours]

Orthotic Devices in Rehabilitation Engineering General orthotics, Classification of orthotics-functional & regional, General principles of Orthosis, Biomechanics of orthoses, merits & demerits of orthotics, Material design consideration in orthotics, Calipers-FO, AFO, KAFO, HKAFO. Spinal Orthosis, Cervical, Head cervical thoracic orthosis, Thoraco lumbar sacral orthosis, Lumbosacroorthosis, Splints-its functions & types.

UNIT V

[10 hours]

Prosthetic Devices

Introduction, Partial Foot Prostheses- Foot-ankle assembly, Trans femoral Prostheses – Knee unit, Axis system, Friction Mechanisms, Extension aid, Stabilizers, Socket. Disarticulation Prostheses-Knee Disarticulation Prostheses, Hip Disarticulation Prostheses.

TEXT BOOK:

Rehabilitation Medicine By Dr. S. Sunder (Jaypee medical publications, New Delhi)
Physical Rehabilitation by Susan B O'Sullivan, Thomas J Schmitz. 5th edition



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	ROBOTICS	Credits	4
Sub.Code	10IT6GE3RB	L-T-P	4-0-0

UNIT I

[07 hours]

Objectives, Classification of robots, Major components of robot, definitions: Kinematics, Controls, and actuators. Robot history, types and applications current and future with examples. Fixed and flexible automation

UNIT II

[10 hours]

Robot Arm Kinematics

Introduction, The direct kinematics problem, Rotation Matrices, Composite rotation Matrix, Rotation matrix about arbitrary axis, Rotation matrix with Euler angle representation, Geometric interpretation of rotation matrix, Homogenous coordinates and transformation matrix, Geometric interpretation of Homogenous transformation matrices, Composite homogenous transformation matrices, Links, Joints, and their parameters, The Denavit - Hartenberg representation, Kinematic equation for manipulator, Other specifications of the locations of the end effectors, Inverse

UNIT III

[10 hours]

Control of Actuators

Objective, Motivation, Closed loop control in position servo, Effect of friction and gravity, Adaptive control, Optimal control, Computed torque technique, Transfer Position control for single joint, Brief discussion on performance and stability criteria.

UNIT IV

[08 hours]

Sensore

Sensor characteristics, Position sensors- potentiometers, Encoders, LVDT, Resolvers, Displacement sensor, Velocity sensor- encoders, tachometers, Acceleration sensors, Force and Pressure sensors – piezoelectric, force sensing resistor, Torque sensors, Touch and tactile sensor, Proximity sensors-magnetic, optical, ultrasonic, inductive, capacitive, eddy-current proximity sensors.

Hall Effect sensors, Binary sensors, Analog sensors, Force and Torque sensing, Elements of a Wrist sensor



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UNIT V

[10 hours]

Vision and Processing :

Image acquisition, illumination Techniques, imaging geometry, some basic transformations, perspective transformations.

Camera model, camera calibration, stereo imaging, Higher-Level Vision: Segmentation, Edge Linking and Boundary detection, Thresholding. Region-oriented segmentation, Use of motion, Description, Boundary descriptors, Regional descriptors.

Mini project:

[7 Hours]

Discussion on DC motors with gears, Stepper motor, Servo motor ,Mini projects using Basic sensors, 555 timers, Motors (DC motors with gears, Stepper motor, Servo motor)

A batch of TWO students are required to undertake a mini project to showcase the knowledge acquired during the course of this study.

Example topics :

1. Line follower robot
2. Obstacle avoiding robot
3. Face reorganization algorithm
4. MATLAB simulation or Use of robo sim
5. PCB design workshop (Using PCB design software)

Note: Carrying out small models / prototypes of projects are mandated which will carry a 20 percent weight in CIE

Project report has to be submitted with following chapters followed by a presentation

1. Abstract
2. Introduction
3. Block diagram
4. Materials used with detailed specification
5. Design and Design issues in detail
6. Model testing



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TEXT BOOKS:

1. **"Robotics – control, sensing, Vision and Intelligence"**, K.S.Fu, R.C.Gonzalez, C.S.G. Lee, McGraw Hill, 1987.
2. **"Robotic Engineering"** - Richard D Klafter, PHI

REFERENCE BOOKS:

1. **"Introduction to Robotics Mechanics and control"**, John J. Craig, 2nd Edition, Pearson education, 2003



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	OPTICAL INSTRUMENTATION	Credits	4
Sub.Code	12IT6GE30I	L-T-P	4-0-0

Objectives:

This course will provide the student with a fundamental understanding of optical system design and instrumentation. The course begins with the foundations of geometrical optics, which includes the first-order properties of systems, and paraxial ray tracing, continues with a discussion of elementary optical systems, and concludes with an introduction to optical materials and dispersion. A special emphasis is placed upon the practical aspects of the design of optical systems.

Outcomes:

Upon the completion of this course student should be able to:

- o Describe the properties, characteristics and applications of lasers
- o Describe scientific and engineering applications of laser such as Doppler velocimeter, holography etc.
- o Understand the importance of integrated optics and its applications of fiber optical sensors.

UNIT I [12 hours]

LASER TYPES AND CHARACTERISTICS : Principles, classification, construction of Ruby, He-Ne, Nd-YAG, semiconductor, Argon and Carbon dioxide lasers. Characteristics of stabilization, Q-switching and mode locking, frequency stabilization, line shape function, lasing threshold, application of lasers in engineering and medicine, safety with lasers.

UNIT II [10 hours]

LASER INSTRUMENTS: laser interferometry, laser strain gauges, velocimetry, pulse echo technique, beam modulation telemetry and holography, application of holography, laser welding, laser machining and laser spectroscopy

UNIT III [08 hours]

OPTOELECTRONIC DEVICES AND COMPONENTS: Photo diodes, PIN diodes, solar cells, LED's phototransistors, opto-isolators, photocouplers.



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UNIT IV

[12 hours]

FIBER OPTICS: light Modulation schemes, optical fibers, intermodal dispersion, graded index fiber, low dispersive fibers Fiber losses, fiber materials, integrated optics, optical bistability, laser printing, optical multiplexers

UNIT V

[10 hours]

OPTICAL FIBER SENSORS: Multimode passive and active fiber sensors, phasemodulated sensors, fiber optic gyroscope, Polarization: polarimetric sensors, polarization, and rotation sensors

TEXT BOOK:

1. "Optoelectronics", Wilson & Hawkes, Prentice Hall of India.
2. "Laser principles and applications", Wilson and Hawkes, Prentice Hall of India

REFERENCE BOOKS:

1. "Essentials of Opto Electronics with Applications", A.J. Rogers, CRC Press.
2. "Principles of Optical Communication & Opto Electronics", L Ravikumar, ala N.Saraswathi, Lakshmi Publications.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	POWER SYSTEMS OPERATION AND CONTROL	Credits	4
Sub.Code	11EE7GE4PS	L-T-P	4-0-0

UNIT I [12 hours]

Power system Control And operating states, digital computer configuration, automatic generation control, area control error, Automatic load frequency control, Automatic load frequency control of single area systems, Speed governing systems Hydraulic valve actuator, Turbine generator response, Static performance of speed governor, Closing of ALFC loop, Concept of Control Area, Static response of primary ALFC loop.

UNIT II [10 hours]

ALFC of multi-area systems (POOL operation), the two-area system, modeling of the tie-line, Block diagram representation of Two-Area Systems, Static response of two area system and Tie line Bias Control, Automatic Voltage regulator: Basic generator control loops, Cross-coupling between control loops, Exciter types, Exciter modeling, Generator modeling, Static performance of AVR loop

UNIT III [10 hours]

Control of voltage and reactive power: Introduction, Generation and Absorption of reactive power, Relation between voltage, power and reactive power at a node, single machine infinite bus systems, methods of voltage control, sub synchronous resonance, voltage stability, voltage collapse, Overview of Economic Operation of Power systems without losses.

UNIT IV [10 hours]

Unit Commitment: Statement of the unit commitment problem, need and importance of unit commitment, Constraints in unit commitment, Unit commitment solution methods- Priority lists

UNIT V [10 hours]

System monitoring and control: Introduction, Energy Management systems, the basis of power system state estimation (PSSE), mathematical description of PSSE process, minimization technique for PSSE, Least square estimation, Error and detection in PSSE, System security and emergency control.



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TEXT BOOKS:

1. **Modern Power System Analysis-** I J Nagarath and D P Kothari, TMH, 3rd Edition, 2003
2. **Electrical Energy Systems Theory**, O.J Elgerd, TMH, 2008.
3. **Power generation, operation and control-** Allen J Wood & Woollenberg. John Wiley and Sons, Second Edition, 2009.
4. **Electric Power Systems-** B.M. Weedy and B.J. Cory, Wiley student edition, 1999
5. **Computer Aided Power System Operation and Analysis-** R.N. Dhar, Tata McGraw-Hill, 1987.

REFERENCE BOOKS:

1. **Computer Aided Power System Analysis-** G.L.Kusic, PHI, 2010.
2. **Power System Analysis, Operation and Control**, Abhijit Chakrabarti and Sunita Halder, PHI, Second Edition, 2009



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	INDUSTRIAL DRIVES AND APPLICATION	Credits	4
Sub.Code	11EE7GE4ID	L-T-P	4-0-0

Course Outcomes

- CO1: Apply the fundamental concepts to comprehend the working of industrial drives and dynamics.
- CO2: Apply the knowledge to select appropriate motor for the specified application to meet the customer requirements
- CO3: Analyze the performance of dc motor drives during various operating conditions
- Co4: Analyze the performance of induction motor during unbalanced conditions, control of induction motor with the help of power electronics circuits.

UNIT I

[08 hours]

AN INTRODUCTION TO ELECTRICAL DRIVES & ITS DYNAMICS: Electrical drives. Advantages of electrical drives, Parts of electrical drives, choice of electrical drives, status of dc and ac drives, Dynamics of electrical drives, Fundamental torque equation, speed torque conventions and multiquadrant operation. Equivalent values of drive parameters, components of low torques, nature and classification of load torques, calculation of time and energy loss in transient operations, steady state stability, load equalization.

UNIT II

[10 hours]

SELECTION OF MOTOR POWER RATING: Thermal model of motor for heating and cooling, Classes of motor duty, determination of motor rating.

INDUSTRIAL DRIVES: Rolling mill drives, cement mill drives, paper mill dries and textile mill drives.



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UNIT III

[12 hours]

D C MOTOR DRIVES:

(a) Starting braking, transient analysis, single phase fully controlled rectifier, control of dc separately excited motor, Single-phase half controlled rectifier control of dc separately excited motor.

(b) Three phase fully controlled rectifier control of dc separately excited motor, three phase half controlled controlled rectifier control of dc separately excited motor, multi-quadrant operation of dc separately excited motor fed from fully controlled rectifier. Rectifier control of dc series motor, chopper controlled dc drives, chopper control of separately excited dc motor. Chopper control of series motor.

UNIT IV

[12 hours]

INDUCTION MOTOR DRIVES:

(a) Operation with unbalanced source voltage and single phasing, operation with unbalanced rotor impedances, analysis of induction motor fed from non-sinusoidal voltage supply, starting braking, transient analysis.

(b) Stator voltage control variable voltage frequency control from voltage sources , voltage source inverter control, closed loop control, current source inverter control, current regulated voltage source inverter control, rotor resistance control, slip power recovery, speed control of single phase induction motors.

UNIT V

[10 hours]

SYNCHRONOUS MOTOR DRIVES: Operation from fixed frequency supply, synchronous motor variable speed drives, and variable frequency control of multiple synchronous motors. Self-controlled synchronous motor drive employing load commutated thyristor inverter

TEXT BOOK:

Fundamentals of Electrical Drives, G.K Dubey , Narosa publishing house, 2nd Edition, 2002.

REFERENCE BOOKS:

1. **Electrical Drives**, N.K De and P.K. Sen- PHI, 2009.
2. **A First Course On Electric Drives**, S.K Pillai-Wiley Eastern Ltd 1990.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	LOW POWER MICROCONTROLLER	Credits	4
Sub.Code	12TC7GE4MC	L-T-P	3-0-1

Objectives

Ability to design, build, and debug simple microcontroller based systems by applying the knowledge of Mathematics and Engineering

Ability to use a development environment that includes simulators, debuggers, cross compilers etc in the development of low power applications.

Ability to identify, formulate and develop assembly and C code for mixed signal applications .

Ability to work in a team and thereby learn how to cooperate in teams

UNIT I

[08 hours]

Introduction - Motivation for MSP430 microcontrollers – Low Power embedded systems
Main characteristics of a MSP430 microcontroller, Main features of the MSP430X RISC CPU architecture, Address space, Interrupt vector table, Flash/ROM, Information memory (Flash devices only), Boot memory (Flash devices only), RAM, Peripheral Modules, Special Function Registers (SFRs), Central Processing Unit (MSP430 CPU), Arithmetic Logic Unit (ALU), MSP430 CPU registers, Central Processing Unit (MSP430X CPU), MSP430X CPU registers.

UNIT II

[08 hours]

Addressing modes & Instruction set- Double operand instructions, Single operand instructions, Program flow control – Jumps, Emulated instructions and programming.

UNIT III

[08 hours]

Device Systems and Operating Modes- system reset, system clock, interrupt management, WDT, WDT+, Basic Timer, Capture/Compare blocks, Timer_A Interrupts, Timer_B special features, Real Time Clock (RTC).



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UNIT IV

[08 hours]

On-Chip Peripherals and General Purpose I/O- Hardware multiplier, ADC, DAC, SD16, LCD, DMA, Registers, Interruptible ports, Flashing LED, Blinking the LED, toggle the LED state by pressing the push button, Enable / disable LED blinking by push button.

UNIT V

[07 hours]

Communications: Communications system model, Transmission mode, Synchronous and asynchronous serial communications, Serial Peripheral Interface (SPI) communication protocol, MSP430 communications interfaces, Case Studies of applications of MSP430

Lab Experiments

Basic debug introduction using CCE, eZ430-RF2500 Flashing LED, Memory clock with Basic Timer 1, Real Time Clock with Basic Timer 1, LCD message Display , Sample Temperature using SAR ADC10, Temperature data logger using ADC10 , Data acquisition using ADC12

MSP430-EXP430FG4618 Flashing LED, Voltage ramp generator, Data Memory transfer triggered by software , Multiplication without hardware multiplier, Flash memory programming with the CPU executing the code from flash memory.

REFERENCE BOOKS:

1. John H Davies, MSP430 Microcontroller Basics, Newnes Publications, 2008
2. Teaching MSP430, CD provided by Texas Instruments
3. Chris Nagy, Embedded systems Design using TI MSP430 Series, Newnes Publications, 2003



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	SOFTWARE DEFINED RADIO	Credits	4
Sub.Code	11TC7GE4SR(ONLY EC, TC)	L-T-P	4-0-0

Objective:

This subject knowledge is helpful because in today's radio communication system where components that have been typically implemented in hardware such as mixers, filters, amplifiers, modulators/demodulators, detectors, etc. are instead implemented by means of software on a personal computer or embedded computing devices.

UNIT I

[10 hours]

Introduction

Software Based Radio, A Multi-Dimensional Model Sets the Stage, What is Software Based Radio , Software Defined Radio and Software Radio , Adaptive Intelligent Software Radio and Other Definitions , Functionality, Capability and SBR Evolution , Architectural Perspectives for a Software Based Radio , The Radio Implementer plane , The Network Operator plane, Software Radio Concepts , Adoption Timeframes for Software Based Radio, Realization of Software Based Radio Requires New Technology , Power/Performance/Price Limitations of Handsets Dictates Inflexible Networks, Regulatory Concepts Facilitate SBR Introduction

UNIT II

[12 hours]

Radio Frequency Translation for Software Defined Radio

Requirements and Specifications , Transmitter Specifications , Receiver Specifications, Operating Frequency Bands ,Receiver Design Considerations , Basic Considerations , Receiver Architectures , Dynamic Range Issues and Calculation , Adjacent Channel Power Ratio (ACPR) and Noise Power Ratio (NPR), Receiver Signal Budget , Image Rejection , Filter Functions

within the Receiver , Transmitter Design Considerations , Filtering Analogies between Receiver and Transmitter ,Transmitter Architectures, Transmitter Efficiency and Linearity ,Candidate Architectures for SDR , Zero IF Receivers, Quadrature Local Oscillator, Variable Preselect Filters , Low IF Receivers



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UNIT III

[10 hours]

Radio Frequency Front End Implementations for Multimode SDRs

Evolution of Radio Systems , Evolution of RF Front Ends – Superheterodyne Architecture , The AN2/6 Product Family – Dual Band, Six Mode , The AN2/6 Architecture , Lessons Learned From the AN2/6 , Alternative RF Front End Architectures , Direct Conversion RF Front Ends , Pure Digital RF Front Ends , Analog Digital Combination Solutions , Directions for a Completely Successful SDR RF Front End

UNIT IV

[10 hours]

Data Conversion in Software Defined Radios

The Importance of Data Converters in Software Defined Radios , ADCs for SDR Base Stations , ADCs for SDR Handsets , DACs for SDR Applications , Converter Architectures , Flash Converters , Multistage Converters , Sigma-Delta Converters , Digital-to-Analog Converters , Converter Performance Impact on SDR , Noise Sources – Impact on SDR Sensitivity , SNR of Data Converter , Spurious Impact on Performance , Digital-to-Analog Converter Specification

UNIT V

[10 hours]

The Digital Front End: Bridge Between RF and Baseband Processing

The Front End of a Digital Transceiver, Signal Characteristics , Implementation Issues , The Digital Front End , Functionalities of the Digital Front End , The Digital Front End in Mobile Terminals and Base Stations , Digital Up- and Down-Conversion , Initial Thoughts , Theoretical Aspects , Implementation Aspects , The CORDIC Algorithm , Digital Down-Conversion with the CORDIC Algorithm , Digital Down-Conversion by Subsampling , Channel Filtering , Low-Pass Filtering after Digital Down-Conversion , Band-Pass Filtering before Digital Down-Conversion, Filterbank Channelizers , Sample Rate Conversion , Resampling after Reconstruction , Rational Factor SRC , Integer Factor SRC , Concepts for SRC , Systems for SRC , Example , Design Parameters , Digital Down-Conversion , Sample Rate Conversion , Channel

Mini Project:

At the end of the course students are expected to submit a miniproject on SDR implementation

using Matlab /C/ LabVIEW /FPGA/DSP Processor/ARM Processor



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TEXT BOOK:

Software Defined Radio: Dr Walter Tuttlebee, Wiley

REFERENCE BOOKS:

1. **Bruce Fett, 'Cognitive Radio Technology', Newnes**
2. **'Huseyin Arslan, 'Cognitive radio, software defined radio and adaptive wireless systems', Springer**



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	MULTIMEDIA COMMUNICATION	Credits	4
Sub.Code	12ES7GE4MC	L-T-P	4-0-0

Objective:

Ability to analyze the classifications and applications of Multimedia and identify various communication modes and media types used in Multimedia.

Ability to analyze various communication networks such as LANs, Ethernet, Token ring and Bridges.

Ability to analyze various text representations used in Multimedia and design various text compression techniques.

Ability to identify various image models used in Multimedia and design various image compression techniques such as GIF, TIFF and JPEG.

Ability to analyze various audio processing methods such as synthesized audio and MIDI and video compression techniques such as MPEG and H.261.

Ability to apply technical knowledge and use engineering tools necessary for engineering practice.

Impart education to develop Engineering solutions with an awareness of industry concerns through implementation of a project.

UNIT I

[07 hours]

Fundamentals of Multimedia Communication: Introduction, multimedia information representation, multimedia networks: telephone networks, data networks, broadcast television networks, ISDNs, broadband multiservice networks, multimedia applications: interpersonal communications, interactive applications over internet, entertainment applications.

UNIT II

[08 hours]

Multimedia Information Representation: Media types, communication modes, network types, multipoint conferencing: centralized, decentralized and hybrid modes, network QoS, basic digital principles for multimedia.



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Multimedia Networks: Introduction to networks in multimedia domain, Local Area Networks, concept of Ethernet, Token ring.

UNIT III

[08 hours]

Text Representation and Compression: Text representation, Unformatted text, Formatted text, Hypertext, Introduction to compression techniques in multimedia, Text compression principles, Entropy encoding, Source encoding, Transform encoding, Text compression principles: Static Huffman coding ,Arithmetic coding, Basics of LZW coding, Brief overview of other text compression standards.

UNIT IV

[08 hours]

Image Representation and Compression: Image representation, Graphics, Digitized documents, Digitized Pictures, Raster scan principles, Three color image capture methods, Image compression principles, Image compression techniques: Graphics Interchange Format, JPEG: Image Preparation, Block Preparation, DCT, Quantization, Entropy encoding, Frame builder, Basics of JPEG decoder, Introduction to TIFF and JPEG 2000.

UNIT V

[08 hours]

Audio Compression: Introduction to audio compression, PCM Speech, CD quality audio, Synthesized audio, MIDI, Brief overview of various audio compression standards.

Video Compression: Introduction to Video compression: Broadcast TV, Color signals, Luminance and Chrominance, Signal bandwidth, digital video: 4:2:2 format, 4:2:0 format, HDTV format, Video compression techniques: Introduction to MPEG and Brief overview of other MPEG standards.

MINI PROJECT:

Mini project would be preceded by lab sessions that would include discussion of prerequisites to undertake the project. The 2 lab sessions would include experiments based on image processing / speech processing using tools such as MATLAB / LABVIEW.

A batch of THREE students is required to undertake a mini project to showcase the knowledge acquired during the course of this study. The project may be pursued with respect to the following sub – domains:

1. Image processing techniques such as enhancement, restoration, segmentation etc.
2. Image compression techniques such as JPEG, JPEG 2000, TIFF etc.
3. Text processing techniques like Huffman coding etc.



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4. Text Compression techniques such as LZW coding, ZIP, RAR etc.
5. Audio / Speech compression techniques.
6. Video processing / compression techniques such as MPEG etc.

Implementation of the project including the project report would carry 50% (i.e. 25 out of 50) of the CIE marks.

Project Report has to be submitted with the following chapters followed by demonstration:

1. Abstract
2. Contents
3. Introduction
4. Description of the Project
5. Source Code of the Project
6. Results (Simulation / Snapshots)
7. Conclusion and Future Enhancements
8. Bibliography.

TEXT BOOK:

Multimedia Communications: Applications, Networks, Protocols, and Standards – Fred Halsall, Pearson Education, Second Indian reprint 2002.

REFERENCE BOOK:

Data Compression: The Complete Reference – David Salomon, Springer, Fourth Edition, 2007.



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Subject Title	BIOMETRICS	Credits	4
Sub.Code	12ML7GE4BI	L-T-P	4-0-0

Course Outcomes

- Co1: Understand the fundamentals and the need of biometrics.
- Co2: Learn the deployment, strength & weakness of the types of Biometrics.
- Co3: Learn the uncommon biometrics and its usage.
- Co4: Understand the applications of Biometrics.
- Co5: Learn the risks, standards and testing / Evaluation process of Biometrics.

UNIT I **[10 hours]**

Introduction – Benefits of biometric security – Verification and identification – Basic working of biometric matching – Accuracy – False match rate – False non-match rate – Failure to enroll rate – Derived metrics – Layered biometric solutions.

UNIT II **[10 hours]**

Finger scan – Features – Components – Operation (Steps) – Competing finger Scan technologies – Strength and weakness. Types of algorithms used for interpretation. **Voice Scan** - Features – Components – Operation (Steps) – Competing voice Scan (facial) technologies – Strength and weakness.

UNIT III **[10 hours]**

Iris Scan - Features – Components – Operation (Steps) – Competing iris Scan technologies – Strength and weakness. **Facial Scan** - Features – Components – Operation (Steps) – Competing facial Scan technologies – Strength and weakness.

UNIT IV **[10 hours]**

Other physiological biometrics – Hand scan – Retina scan – AFIS (Automatic Finger Print Identification Systems) – Behavioral Biometrics – Signature scan- keystroke scan.

UNIT V **[12 hours]**

Biometrics Application – Biometric Solution Matrix – Bio privacy – Comparison of privacy factor in different biometrics technologies – Designing privacy sympathetic



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biometric systems. Biometric standards – (BioAPI , BAPI) – Biometric middleware.
Biometrics for Network Security: Statistical measures of Biometrics. Biometric Transactions.

TEXT BOOKS:

1. Biometrics–Identity Verification in a Networked World–Samir Nanavati, Michael Thieme, Raj Nanavati, Wiley India Pvt Ltd, 2002
2. Biometrics for Network Security- Paul Reid, Pearson Education, 2004.

REFERENCE BOOKS:

1. Biometrics- The Ultimate Reference- John D. Woodward, Jr. Wiley Dreamtech.
2. Biometric Systems Technology, Design and Performance Evaluation, James Wayman, Anil Jain, Davide Maltoni and Dario Maio, Springer Publications.
3. Personal Identification in Networked Society, Jain, A.K.; R Bolle, Ruud M.; S Pankanti, Sharath, 1st ed. 1999. 2nd printing, 2006, Springer Publications.
4. Handbook of Biometrics, Jain, Anil K.; Flynn, Patrick; Ross, Arun A, Springer, 2008.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	INTRODUCTIONS TO AUDIO AND VIDEO PROCESSING	Credits	4
Sub.Code	12ML7GE4AV	L-T-P	4-0-0

Course Outcomes

- Co1: Gain knowledge about the generation and properties of Audio signals.
- Co2: Understand the video signal properties, picture tubes and Television system, principle of operation of TV cameras.
- Co3: Learn the working principle of color Television system and different Transmission standards.
- Co4: Learn about coding Techniques.
- CO5: Learn the need for different Compression Techniques.

UNIT I [12 hours]

Audio Engineering: Sound waves, Complex sounds, Audio frequency range, loudness, pitch, and decibels. Sound pick up devices (microphones): types: - condenser- carbon, piezoelectric - direction pattern-parameters of microphones: - frequency range- sensitivity-impedance- noise. Sound reproduction devices: types: - horn, cone -typical specifications- Acoustics of speech production and hearing. Recording of Sound: Magnetic recordingsystems -optical storage systems-Coding and decoding applied to CD - CD-R.

UNIT II [10 hours]

Video Engineering: Elements of Television System:- Basic Block Schematic of Monochrome TV Transmitter and receiver, Gross structure, flicker& interlaced scanning ,number of scanning lines. Horizontal and Vertical resolution, Resolution and Bandwidth. Composite video signal- Vertical and horizontal synchronization, Vestigial Sideband Transmission, transmission of Sound signal. Modulation Positive and Negative Modulation and its comparison - Picture tubes. Television Cameras, Working Principle and operation of CCD cameras.

UNIT III [12 hours]

Colour Television: Compatibility considerations, Colour response of human eye, three colour theory, additive mixing of colours, chromaticity diagram, Luminance and chrominance, Block schematic explanation of Colour TV Cameras. Colour difference signal



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and its generation. Colour signal transmission, Modulation of colour Difference signals and colour burst signal. Basic Colour Television Systems: PAL, NTSC and SECAM.- Block Schematic, explanation and Comparison. Colour TV picture tubes: CRTs, LCD and Plasma displays.

UNIT IV

[08 hours]

Audio and Video coding: Introduction to Audio Coding, Audio compression, MPEG – Block diagram of audio encoder and decoder, Digital Audio Broadcasting- Block schematic explanation.

UNIT V

[10 hours]

Video coding and compression: Need for compression- video image representation – quantization of image data. Intra frame compression techniques: DPCM–DCT based transform coding, Motion Compensation –H261 videoconference coding standard-MPEG video compression- HDTV- DVB-T

TEXTBOOKS

1. RR Gulati, Monochrome and Colour Television, New Asian Age
2. Fred Halsal , Multimedia Communications ,Pearson Education

REFERENCE BOOKS:

Thomas Quatieri , Discrete Time Speech Signal Processing: Principles and practice , Pearson Education



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	WIRELESS COMMUNICATION(Except TC)	Credits	4
Sub.Code	11EC7GE4WC	L-T-P	4-0-0

Course Outcomes

- Co1: Recall the history, application and requirements of wireless services.
- Co2: Gain Knowledge about the concepts involved in cellular radio communication.
- Co3: Understand propagation mechanisms and the its effects in wireless communication.
- Co4: Describe diversity techniques and summarize basic equalization schemes.
- Co5: Explain Second generation digital cellular mobile communication systems (GSM)

UNIT I

[08 hours]

Introduction: Application and requirements of wireless services, History, types of services, requirements for services, Economical and social aspects. Spectrum limitations, limited energy, user mobility.

UNIT II

[12 hours]

The Cellular concept: System design fundamentals: Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Trunking and Grade of service, Improving coverage and capacity in cellular system.

UNIT III

[12 hours]

Mobile radio propagation: Large scale path loss – Introduction to Radio wave propagation, free space propagation model, relating power to electric field, Reflection, Ground Reflection model, Diffraction, Scattering.

Small scale fading- small-scale multipath propagation, Impulse response model of a multipath channel, small scale multipath measurements, Parameters of mobile multipath channels, Types of small scale fading.



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UNIT IV

[10 hours]

Equalization and Diversity: Fundamentals of Equalization, Training a Generic Adaptive Equalizer, Equalizers in communication receiver, Survey of Equalization Techniques, Linear and non-linear equalization, Algorithms for Adaptive Equalization, Fractionally Spaced equalizers, Diversity techniques, RAKE receivers.

UNIT V

[10 hours]

Global System for Mobile communication: System overview, The air interface, Logical and physical channels, synchronization, coding , circuit switched data transmission, Establishing a communication and handoff, Services and billing.

TEXT BOOKS:

1. **Wireless Communication-** Andreas F Molish, Wiley Student, Second Edition (Units 1&5)
2. **Wireless Communication- Principles and Practice,** Theodore S Rappaport, Second Edition (Units 2, 3&4)



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	EMBEDDED SYSTEM DESIGN	Credits	4
Sub.Code	11EC7GE4ES	L-T-P	4-0-0

Course Outcomes

- Co1: Recognize the hardware requirements for developing an embedded system.
- Co2: Analyze and illustrate the optimized software architecture in a multitasking embedded environment
- Co3: Acquire knowledge in real time operating system and software tools.

UNIT I

[10 hours]

Introduction to Embedded System:

Introduction to functional building blocks of embedded systems – Register, memory devices, ports, timer, and interrupt controllers using circuit block diagram representation for each category.

UNIT II

[08 hours]

Processor and Memory Organization:

Structural units in a processor; selection of processor & memory devices; shared memory; DMA; interfacing processor, memory and I/O units; memory management – Cache mapping techniques, dynamic allocation - Fragmentation.

UNIT III

[10 hours]

Devices & Buses for Devices Network: I/O devices, timer & counting devices; serial communication using I2C, CAN, USB buses; parallel communication using ISA, PCI, PCI/X buses, arm bus; interfacing with devices/ports, device drivers in a system – Serial port & parallel port.

UNIT IV

[12 hours]

I/O Programming Schedule Mechanism: Intel I/O instruction – Transfer rate, latency; interrupt driven I/O - Non-maskable interrupts; software interrupts, writing interrupt



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service routine in C & assembly languages; preventing interrupt overrun; disability interrupts. Multi threaded programming – Context switching, premature & non-premature multitasking, semaphores.

Scheduling – Thread states, pending threads, context switching, round robin scheduling, priority based scheduling, assigning priorities, deadlock, watch dog timers.

UNIT V

[12 hours]

Real Time Operating System (RTOS):

Introduction to basic concepts of RTOS, Basics of real time & embedded system operating systems, RTOS – Interrupt handling, task scheduling; embedded system design issues in system development process – Action plan, use of target system, emulator, use of software tools

TEXT BOOKS:

1. Rajkamal, '**Embedded System – Architecture, Programming, Design**', Tata McGraw Hill, 2003.
2. Daniel W. Lewis '**Fundamentals of Embedded Software**', Prentice Hall of India, 2004.

REFERENCE BOOK:

- 1 David E. Simon, '**An Embedded Software Primer**', Pearson Education, 2004.
- 2 Frank Vahid '**Embedded System Design – A Unified hardware & Software Introduction**' John Wiley, 2002.
- 3 Sriram V. Iyer, Pankaj Gupte, '**Embedded Real Time Systems Programming**', Tata McGrawHill, 2004.
- 4 Steve Heath, '**Embedded System Design**', II edition, Elsevier, 2003



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU)

Subject Title	DISTRIBUTED COMPUTING	Credits	4
Sub.Code	11IT7GE4DC	L-T-P	4-0-0

Objectives:

This course is designed to provide clear understanding of fundamental concept and design principles that underlie a distributed computing system.

UNIT I

[10 hours]

INTRODUCTION:

Scope, goals, motivation, historical development, architectural models, design issues.

NETWORKS & PROTOCOLS:

Computer network principles, local network technologies, protocols for distributed systems, asynchronous transfer mode network

UNIT II

[10 hours]

REMOTE PROCEDURE CALLING:

Introduction, characteristics of remote procedure calling, interface definitions, binding, the RPC

software, and implementation of RPC with lightweight process.

UNIT III

[11 hours]

SYNCHRONIZATION IN DISTRIBUTED SYSTEMS:

Clock synchronization, mutual exclusion, election Algorithm, dead lock in distributed systems.

PROCESS AND PROCESSOR IN DISTRIBUTED SYSTEMS:

Threads, processor allocation, scheduling.

UNIT IV

[11 hours]

DISTRIBUTED DATABASES:

Division of responsibilities, file service, access control, directory service, and implementation.

STRUCTURED DISTRIBUTED DATABASES:

Overview of client server, architecture, data fragmentation, replication and allocation techniques over processing.



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UNIT V

[10 hours]

CASE STUDY:

Introduction, locus, sun network file system, Cambridge file server, Ameba, mach, Apollo domain.

TEXT BOOKS:

1. **"Modern Operating Systems"**, A S Tanenbaum PHI 1996
2. **"Distributed systems, concepts and design"**, George F Coulounis & Jeon dollimose

REFERENCE BOOK

1. **"Distributed computing systems, synchronization, control and communication"**, Parkar & Venis J P; Academic press 1983
2. **"Distributed data base principles and systems"**, Ceri S & Pelagatt, Mc-Graw Hill 1984
3. **"Distributed operating systems"**, Pradeep K Sinha --PHI 1998.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	MEDICAL IMAGING SYSTEMS	Credits	4
Sub.Code	11IT7GE4MI(EXCEPT ML)	L-T-P	4-0-0

Objective:

The course focuses in the area of Therapeutic instruments . The evolution of ultrasonic medical imaging, computerized tomography & NMR Scanners are introduced in the syllabus to provide an inner depth to these diagnostic equipments / instruments .

*development of prototype

*Applying this knowledge in the design of smart sensors with portable equipment.

UNIT I [10 hours]

X-RAYS: Interaction between X-Rays and matter, Intensity of an X-Ray, Attenuation, X-Ray Generation and Generators, Beam Restrictors and Grids, Intensifying screens, fluorescent screens and Image intensifiers.

UNIT II [09 hours]

COMPUTED TOMOGRAPHY: Conventional tomography, Computed tomography principle, Projection function Generations of CT machines, Electron beam CT, Reconstruction algorithms, Helical CT.

UNIT III [09 hours]

ULTRASOUND IMAGING: Acoustic propagation, Attenuation, Absorption and Scattering, Ultrasonic transducers, Arrays, A mode, B mode, M mode scanners, Tissue characterization, Color Doppler flow imaging.

UNIT IV [11 hours]

MAGNETIC RESONANCE IMAGING: Angular momentum, Magnetic dipole moment, Magnetization, Larmor frequency, Rotating frame of reference, Free induction decay, Relaxation times, Pulse sequences. Introduction to functional MRI.

UNIT V [13 hours]

THERMAL IMAGING: Medical thermography, Infrared detectors, Thermographic equipment, Pyroelectric vidicon camera.



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RADIONUCLIDE IMAGING: Interaction of nuclear particles and matter, Nuclear Radionuclide generators, Nuclear radiation detectors, Rectilinear scanner, scintillation camera, SPECT, PET.

TEXT BOOKS:

1. **Principles of Medical Imaging**- Kirk shung, Academic Press.
2. **Handbook of Biomedical Instrumentation**- Khandpur, Tata McGraw-Hill Publishing Company Ltd., 2nd Edition, 2003.

REFERENCE BOOK:

- 1, **Medical Imaging Signals and Systems**- Jerry L Prince and Jonathan M Links, Prenti Hall of India/Pearson Education.
2. **Fundamentals of medical Imaging**- Zhong Hicho and Manbir singh, John Wiley.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	ELECTRICAL POWER QUALITY	Credits	4
Sub.Code	12EE7GE5PQ	L-T-P	4-0-0

Course Outcomes

- Co1: Get sensitized to the power quality issues & concerns of the country.
- CO2: Identify the type of Power quality problem, source and relevant IEEE standards.
- CO3: Identify, evaluate and find solutions for power quality problems.
- CO4: Decide on choosing the necessary monitoring equipment & mitigation techniques.

UNIT I

[09 hours]

Introduction to Power Quality; Definition Of Power Quality; Causes Of Disturbances In Power

Systems; Need For Power Quality, Power Quality Evaluation Procedure.

UNIT II

[09 hours]

Classification Of Power Quality Issues; Transients, Short Duration Voltage Variations, Long Duration Voltage Variations, Voltage Imbalance, Waveform Distortions, Voltage Fluctuations And Flicker, Power Frequency Variations.

UNIT III

[12 hours]

Measures used for power quality; harmonics, average value of non sinusoidal waveform, RMS value of non sinusoidal waveform, form factor(FF), ripple factor(RF), harmonic factor(HF), lowest order harmonic(LOH), total harmonic distortion(THD), total inter harmonic distortion (TIHD), total sub harmonic distortion(TSHD), total demand distortion (TDD), distortion power (D).



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sUNIT IV

[10 hours]

Power Quality Measurement Equipment; Types Of Instruments, Wiring And Grounding Testers, Multi-Meters, Digital Cameras, Oscilloscopes, Disturbance Analyzers, Spectrum Analyzers And Harmonic Analyzers, Flicker Meters, Smart Power Quality Meters, Transducer Requirements.

UNIT V

[12 hours]

Overview Of Mitigation Methods; From Fault To Trip, Reducing The Number Of Faults, Reducing The Fault-Clearing Time, Changing The Power System, Equipment , Improving Equipment Immunity, Different Events And Mitigation Methods, Summary and future direction.

TEXT BOOKS:

- 1) Power quality in power systems and electrical machines- Ewald F Fuchs: Mohammad A S Masoum; First Indian Reprint 2009, Indian reprint ISBN: 978-81-312-2350-5; Academic Press-An imprint of Elsevier
- 2) Electrical power systems quality, Second Edition, Roger, C Dugan/Mark F McGranaghan/Surya Santosa/H Wayne Beaty; Tata McGraw Hill Edition.

REFERENCE BOOK:

Understanding Power quality problem: voltage fags and interruptions by Mat H Bollen, First Edition, IEEE Press



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU)

Subject Title	SWITCH MODE POWER SUPPLIES	Credits	4
Sub.Code	11EE7GE5SP	L-T-P	4-0-0

UNIT I

[10 hours]

INTRODUCTION TO DC-DC SWITCHED MODE CONVERTERS: Basic Topologies, Buck, boost, buck-boost, and Cuk converters.

UNIT II

[08 hours]

FULL BRIDGE DC-DC CONVERTER: Detailed theory, working principles, modes of operation, with detailed circuits and wave forms, applications, merits and demerits (Operation of the above converters is CCM mode only)

UNIT III

[10 hours]

DC-AC SWITCHED MODE INVERTERS: Single-phase inverter, three phase inverters. SPWM inverter, detailed theory, working principles, modes of operation with circuit analysis, applications, merits and demerits, problems based on input output voltage relationship.

UNIT IV

[14 hours]

RESONANT CONVERTERS: Zero voltage and zero current switching, resonant switch converters, and comparison with hard switching, switching locus diagrams, and working principle.

UNIT V

[10 hours]

POWER SUPPLIES: Introduction, DC power supplies: fly back converter, forward converter, push-pull converter, half bridge converter, full bridge converter, AC power supplies: switched mode ac power supplies, resonant ac power supplies, bidirectional ac power supplies.

TEXT BOOKS:

1. **Power Electronics-** converters, application & design- Mohan N, Undeland T.M., Robins, W.P-John Wiley 1989
2. **Power Electronics-Circuits, Devices, Applications-** Rashid M.H.-3rd Edition, Prentice Hall India, 2008.
3. **Power Electronics and A.C. Drives-** Bose B.K.-Prentice Hall 1986.
4. **Digital Power Electronics And Applications-** Muhammad Rashid. first edition, 2005, Elsevier



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU)

Subject Title	EMC-EMI	Credits	4
Sub.Code	11TC7GE5EM	L-T-P	4-0-0

Objective:

- ability to apply the knowledge of EMC/EMI to examples
- ability to apply the knowledge of electromagnetics and measurements to instruments
- ability to apply the knowledge of EMC standards and regulations
- ability to apply the knowledge of EMI control methods
- ability to design PCB considering trace routing, impedance control, decoupling, zoning and grounding

UNIT I

[11 hours]

BASIC CONCEPTS:

Definition of EMC, EMI with examples, SMPS, UPS, Classification of EMC/EMI-CE,RE,CS,RS, Units of parameters, Sources of EMI, EMI coupling modes CM,DM,ESD phenomena and effects, Transient phenomena and suppression

UNIT II

[11 hours]

EMI MEASUREMENTS :

Basic principles of RE,CE, RS, CS measurements, EMI measuring instruments-Antennas, LISN, feed through capacitor, current probe, EMC analyzer, and detection technique, open area site, shielded anechoic chamber, TEM cell

UNIT III

[10 hours]

EMC STANDARD AND REGULATIONS: National and international standardizing organizations,-FCC, CE, and RE standards, frequency assignment-spectrum conversation



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UNIT IV

[10 hours]

EMI CONTROL METHODS AND FIXES:

Shielding, grounding, bonding, filtering, EMI gasket, isolation transformer, optical isolator

UNIT V

[10 hours]

EMC DESIGN AND INTERCONNECTION TECHNIQUES:

Cable routing and connection, component selection and mounting, PCB design-Trace routing, impedance control, decoupling, zoning and grounding

TEXT BOOK:

1. Prasad Kodali.V - Engineering Electromagnetic Compatibility - S.Chand&Co - New Delhi-2000
2. Clayton R.Paul - Introduction to Electromagnetic compatibility - Wiley & Sons - 1992

REFERENCE BOOKS:

1. Keiser - Principles of Electromagnetic Compatibility - Artech House - 3rd Edition - 1994
2. Donwhite Consultant Incorporate - Handbook of EMI / EMC - Vol I - 1985



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	SATELLITE COMMUNICATION	Credits	4
Sub.Code	11TC7GE5SC	L-T-P	4-0-0

Objective:

- ability to apply the knowledge of Kepler's laws to satellite orbits
- ability to apply the knowledge of communication and control in satellite subsystems
- ability to design communication modules considering power, bandwidth, cost, environment and safety
- ability to identify, formulate and solve problems in satellite link

UNIT I

[11 hours]

OVER VIEW OF SATELLITE SYSTEMS: Introduction, frequency allocation, INTEL Sat, India in space. **ORBITS:** Kepler laws, orbital elements, orbit perturbations, inclined orbits, calendars, orbital plane and sun synchronous orbits, Geostationary orbit: antenna look angles, limits of visibility, earth eclipse of satellite, sun transit outage, launching orbits

UNIT II

[11 hours]

PROPAGATION IMPAIRMENTS AND SPACE LINK: Introduction, atmospheric loss, ionospheric effects, rain attenuation, other impairments.

SPACE LINK: Introduction, EIRP, transmission losses, link power budget, system noise, CNR, uplink, down link, effects of rain, combined CNR

UNIT III

[10 hours]

SPACE SEGMENT: Introduction, Power supply units, Attitude control, Station keeping, Thermal control, Telemetry tracking and command, Transponders, Antenna subsystem

UNIT IV

[10 hours]

SATELLITE ACCESS: Pre-assigned FDMA, SCPC (spade system), TDMA, pre-assigned TDMA, demand assigned TDMA, down link analysis, comparison of uplink power requirements for TDMA & FDMA, On board signal processing, satellite switched TDMA.



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UNIT V

[10 hours]

SATELLITE SERVICES: DBS, orbital spacing, power ratio, frequency and polarization, transponder capacity, bit rates for digital TV, satellite mobile services, VSAT, RadarSat, GPS, orbcomm

TEXT BOOK:

Satellite Communications, Dennis Roddy, 4th Edition, McGraw-Hill International edition, 2006.

REFERENCE BOOKS:

1. **Satellite Communications**, Timothy Pratt, Charles Bostian and Jeremy Allnutt, 2nd Edition, John Wiley & Sons, 2003.
2. **Satellite Communication Systems Engineering**, W. L. Pitchand, H. L. Suyderhoud, R. A. Nelson, 2nd Ed., Pearson Education., 2007.
3. **Satellite Communication Systems Engineering**-Louis J. Ippolito Jr, Wiley Publishers.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	ASIC DESIGN	Credits	4
Sub.Code	11ES7GE5AD	L-T-P	4-0-0

Objective:

The course deals with the study of the hardware structure, synthesis methods, design methodology and design flow from the application to ASIC chip.

Note : All Designs Will Be Based On VHDL

UNIT I

[10 hours]

Introduction: Full Custom with ASIC, Semi custom ASICS, Standard Cell based ASIC, Gate array based ASIC, Channeled gate array, Channel less gate array, structured get array, Programmable logic device, FPGA design flow, ASIC cell libraries

UNIT II

[10 hours]

Data Logic Cells: Data Path Elements, Adders, Multiplier, Arithmetic Operator, I/O cell, Cell Compilers

ASIC Library Design: Logical effort: practicing delay, logical area and logical efficiency logical paths, multi stage cells, optimum delay, optimum no. of stages, library cell design.

UNIT III

[11 hours]

Low-level Design Entry: Schematic Entry: Hierarchical design. The cell library, Names, Schematic, Icons & Symbols, Nets, schematic entry for ASIC'S, connections, vectored instances and buses, Edit in place attributes, Netlist, screener, Back annotation

ASIC Construction

UNIT IV

[11 hours]

Floor Planning : Physical Design, CAD Tools, System Partitioning, Estimating ASIC size, partitioning methods. Floor planning tools, I/O and power planning, clock planning ,



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UNIT V

[10 hours]

Placement and Routing placement algorithms, iterative placement improvement, Time driven placement methods. Physical Design flow global Routing , Local Routing , Detail Routing, Special Routing, Circuit Extraction and DRC .

TEXT BOOK:

M J.S .Smith, - "**Application - Specific Integrated Circuits**" – Pearson Education, 2003

REFERENCE BOOKS:

1. Jose E.France , Yannis Tsividis, "**Design of Analog -Digital VLSI Circuits for Telecommunication and Signal Processing**" ,Prentice Hall, 1994.
2. Malcolm R.Haskard; Lan. C. May, "**Analog VLSI Design -NMOS and CMOS**" Prentice Hall, 1998.
3. Mohammed Ismail and Terri Fiez , "**Analog VLSI Signal and Information Processing**", McGraw Hill, 1994 .



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU)

Subject Title	ADVANCED MEDICAL IMAGE PROCESSING	Credits	4
Sub.Code	11ML7GE5IP	L-T-P	4-0-0

Course Outcomes

- Co1: Learn the concept of morphological operations to segment and analyze the image.
- Co2: Learn the different methods of image representation and image description.
- Co3: Learn the methods of object detection and recognition.
- Co4: Learn the concept of Wavelet Transform and its applications to image smoothing and compression.
- CO5: Learn the applications of image processing techniques to Medical images.

UNIT I

[12 hours]

MORPHOLOGICAL IMAGE PROCESSING: Preliminaries, Erosion, Dilation, Duality, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms, Boundary Extraction, Hole Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening, Skeletons, Pruning, Morphological Reconstruction, Summary of Morphological Operations of Binary Images, Gray-Scale Morphology, Erosion and Dilation, Opening and Closing, Some Basic Gray-Scale Morphological Algorithms, Gray-Scale Morphological Reconstruction.

UNIT II

[08 hours]

IMAGE SEGMENTATION: Fundamentals, Point, Line, and Edge Detection, Background, Detection of Isolated Points, Line Detection, Edge Models, Basic Edge Detection, More Advanced Techniques for Edge Detection, Edge Linking and Boundary Detection, Thresholding, Foundation, Basic Global Thresholding, Optimum Global Thresholding Using Otsu's Method, Thresholding Image Smoothing to improve Global Thresholding, Edges to improve Global

Thresholding, Multiple Thresholds, Variable Thresholding, Multivariable Thresholding, Region- Based Segmentation, Region Growing, Region Splitting and Merging, Segmentation Using Morphological watersheds, Background, Dam Construction, watershed segmentation Algorithm, The Use of Markers, The Use of Motion in Segmentation, Spatial Techniques, Frequency Domain Techniques.



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UNIT III

[10 hours]

REPRESENTATION AND DESCRIPTION: Representation, Boundary (Border) Following, Chain Codes, Polygonal Approximations Using Minimum-Perimeter Polygons, Other Polygonal Approximation Approaches, Signatures, Boundary Segments, Skeletons, Boundary Descriptors, Shape Numbers, Fourier Descriptors, Statistical Moments, Regional Descriptors, Some Simple Descriptors, Topological Descriptors, Texture, Moment Invariants, Use of Principal Components for Description Relational Descriptors.

UNIT IV

[10 hours]

OBJECT RECOGNITION: Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods, Matching, Optimum Statistical Classifiers, Neural Networks, Structural Methods, Matching Shape Numbers, String Matching.

UNIT V

[12 hours]

WAVELETS AND MULTIREOLUTION PROCESSING: Image Pyramids, Sub band Coding, The Haar Transform, Multi resolution Expansions, Series Expansions, Scaling Functions, Wavelet Functions, Wavelet Transforms in One Dimension, The Wavelet Series Expansions, The Discrete Wavelet Transform, The Continuous Wavelet Transform. The Fast Wavelet Transform. Wavelet Transforms in Two Dimensions. Wavelet Packets

TEXT BOOK:

Digital Image Processing by RafaelC. Gonzalez & Richard E. Woods, Third Edition. Pearson Education Inc.

REFERENCE BOOKS:

1. **Digital Image Processing using MATLAB** by RafaelC. Gonzalez & Richard E. Woods, Second Edition. Pearson Education Inc.
2. **Image Processing, Analysis and Machine-Vision** by Milan Sonka, Vaclav Hlavac & Roger Boyle, Second Edition
3. **Digital Image Processing** by S Jayakumaran, S Esakkirajan, T Veerakumar, Tata McGraw Hill Education Private Ltd.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU)

Subject Title	ADVANCED BIOMEDICAL DIGITAL SIGNAL PROCESSING	Credits	4
Sub.Code	11ML7GE5SP	L-T-P	4-0-0

Course Outcomes

- Co1: understand the concepts of random signal processing
- Co2: understand the fundamentals of time series analysis
- Co3: understand the concepts of spectral analysis methods
- Co4: understand the concepts of spectral estimation analysis methods
- CO5: Know the Significance of wavelets and its applications on De-noising and compression techniques.

UNIT I

[10 hours]

INTRODUCTION: Discrete and continuous Random variables, Probability distribution an density functions. Gaussian and Raleigh density functions, Correlation between random variables.

Stationary random process, Ergodicity, Power spectral density and autocorrelation function of random processes. Noise power spectral density analysis, Noise bandwidth, noise figure of systems.

UNIT II

[10 hours]

TIME SERIES ANALYSIS: Introduction to time series analysis, AR, MA and ARMA models, Parameter estimation of ARMA models (Maximum likelihood method), Process order estimation, Adaptive segmentation, autocorrelation measure (ACM) method, spectral error measure(SEM) method.

UNIT III

[08 hours]

SPECTRAL ANALYSIS: Introduction to spectral analysis, the PSD, Cross – Spectral Density and coherence functions, Linear filtering, the Wiener filter, Cepstral analysis. Homomorphic filtering



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UNIT IV

[12 hours]

SPECTRAL ESTIMATION: Introduction, estimation based on Fourier transform, the expected value of the Periodogram, weighted overlapped segment averaging (WOSA), smoothing of the Periodogram, estimation based on Maximum entropy method (MEM) and the AR method, the Moving average (MA) method, Autoregressive moving average (ARMA) methods, Prony's method, Maximum likely hood method (MLM), comparison of several methods.

UNIT V

[12 hours]

WAVELETS: Introduction to Wavelets: Multi resolution, Formulation of Wavelet systems, The Scaling Functions, and scaling Coefficients, Wavelet and Wavelet Coefficients, Calculation of the Discrete Wavelet Transform, Wavelet-Based Signal Processing and Applications.

TEXT BOOKS:

1. Biomedical Signal Processing: Time & Frequency Analysis (Vol-1) by Arnon Cohen., CRC Press, 1986.
2. Introduction to Wavelets and Wavelet Transforms, Burrus, Gopinath and Gao, Prentice Hall, 1998.

REFERENCE BOOKS:

1. Biomedical Signal Analysis by Rangaraj M. Rangayyan – . IEEE Press, 2001.
2. Biomedical Signal Processing by Martin Akay, Academic, Press 1994
3. Wavelet Transforms by Raghuvver M. Rao and Ajit S. Bopardikar, Pearson, 1998.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU)

Subject Title	LOW POWER VLSI DESIGN	Credits	4
Sub.Code	11EC7GE5LP	L-T-P	4-0-0

Course Outcomes

- Co1: Recognize the importance of Low Power circuit design and identify related issues.
- Co2: Analyze power dissipation using mathematical and probabilistic approach in low power logic cells.
- Co3: Identify the effect of clock tree synthesis method and process variations on power dissipation

UNIT I

[08 hours]

Introduction to Low power CMOS design: Need for Low Power VLSI chips, charging and discharging capacitance, Short circuit current in CMOS circuit, CMOS leakage current, Static current, Basic Principles of low power design, Low power figure of merit.

UNIT II

[12 hours]

Power Analysis: Simulation Power Analysis: Spice circuit simulation, Discrete transistor modeling, Gate level logic simulation, architecture level analysis, Monte-Carlo simulation, Probabilistic Power analysis: Random Logic signals, Probability and frequency, Probabilistic power analysis techniques, Signal entropy.

UNIT III

[10 hours]

Low power circuit techniques: Power consumption in circuits, Flip-flops and latches, logic, high capacitance nodes.



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UNIT IV

[10 hours]

Energy recovery in CMOS: A look at practical details, retractile logic, reversible pipelines, High performance approaches.

UNIT V

[12 hours]

Clock distribution and logic synthesis for low power: Low power Clock distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Process variations in buffer and device sizing, Low power logic synthesis: Power estimation techniques, power minimization techniques.

TEXT BOOKS:

1. **Practical Low Power Digital VLSI design**, Gary Yeap, Kluwer academic publishers, 1998.
2. **Low Power design Methodologies** , Jan M Rabaey, Massoud Pedram, Kluwer academic publishers, 2002.

REFERENCE BOOK:

1. **Low Power CMOS VLSI circuit design**, Kaushik Roy, Sharat C Prasad, Wiley Interscience publication, 2000.
2. **Low Power Design in deep submicron Electronics**, W. Nebel, J. Mermet, Kluwer academic publishers, 1997.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU)

Subject Title	NETWORK SECURITY	Credits	4
Sub.Code	11ES7GE5NS	L-T-P	4-0-0

Course Outcomes

- Co1: Recognize the security issues involved in networks and describe its counter measures using various cryptographic techniques.
- Co2: Acquire knowledge on mathematics for modern data encryption methods.
- Co3: Apply various public and private key encryption techniques for secure communication over the networks.
- Co4: Investigate security aspects involved in e-communications.
- Co5: Illustrate the intrusion mechanisms involved in network transactions.

UNIT I

[12 hours]

Services, Mechanisms and Attacks, The OSI security Architecture, A model for network security. Symmetric Ciphers: Symmetric Cipher model, Substitution techniques, Transposition technique, Simplified DES, Data encryption Standard, The strength of DES, Differential and linear cryptanalysis, Block cipher design principles and modes of operation.

UNIT II

[10 hours]

Introduction to finite fields- Groups ,rings and fields, modular arithmetic, Euclid's Algorithm, Finite fields of the form $GF(p)$, Polynomial arithmetic, Finite Fields of the form $GF(2^n)$. Prime numbers, Fermat's and Euler's Theorems, Testing for primality, the Chinese Remainder Theorem, and Discrete logarithms.

UNIT III

[10 hours]

Principles of Public key cryptosystems, The RSA algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Arithmetic, Authentication functions, Digital signatures, Digital signature standard.



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UNIT IV

[10 hours]

Electronic Mail Security- Pretty Good Privacy, S/MIME Web security- Secure Electronic Transaction.

UNIT V

[10 hours]

Intruders, Intruder detection, Password management, Viruses and related threats. Firewalls
Design Principles, Trusted systems.

TEXT BOOK:

1. **Cryptography and Network Security**-Principles and Practice:William Stallings, Third Edition.

REFERENCE BOOKS:

1. **Fundamentals of Network Security**-Eric Maiwald, 2009 Edition, Information Security Series
2. **Network Security-Private Communication in a public World**:Charlie Kaufman, Radia Perlman, Mike Speciner, Second Edition



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU)

Subject Title	EMBEDDED SYSTEM & RTOS	Credits	4
Sub.Code	11IT 7GE5ES	L-T-P	4-0-0

UNIT I

[10 hours]

INTRODUCTION: An Embedded System; Characteristics of Embedded Systems; Software embedded into a system; Real Time Definitions, Events and Determinism, Synchronous & Asynchronous Events, Determinism, Sequence Control, Loop control, Supervisory control, Centralized computer control, Hierarchical and Distributed system, Human-computer interface, Benefits of computer control systems.

UNIT II

[10 hours]

OPERATING SYSTEMS: Introduction, Real-time multi-tasking OS, Scheduling strategies, Priority Structures, Task management, Scheduler and real-time clock interrupt handles, Memory Management, Code sharing, Resource control, Task co-operation and communication, Mutual exclusion, Data transfer, Liveness, Minimum OS kernel, Examples.

UNIT III

[12 hours]

REAL TIME SPECIFICATIONS AND DESIGN TECHNIQUE: Mathematical specifications, flow charts, structure charts, Finite state automata, data flow diagrams, Petri Nets, Warnier Orr Notation, State charts.

PROCESSOR AND MEMORY ORGANIZATION: Structural Units in a Processor; Memory Devices, Memory selection for an embedded system; Direct Memory Access, DMA controllers; Interfacing Processor, Memory and I/O Devices.

UNIT IV

[10 hours]

INTERRUPT SERVICING (HANDLING) MECHANISM: Context and the periods for context switching; Deadline and interrupt latency. Language Features: Parameter passing, Recursion, Dynamic allocation, Typing, exception handling, abstract data typing.

REAL TIME KERNELS: Real Time and Embedded Operating Systems; Interrupt Routines in RTOS environment; co routines, Interrupt driven systems, Foreground/background systems, Full- featured Real Time Operating Systems.



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UNIT V

[10 hours]

INTER-PROCESS COMMUNICATION AND SYNCHRONIZATION OF PROCESSES:

Multiple processes in an application; Problem of sharing data by multiple tasks and routines; Inter Process Communication, Mailboxes, Critical Regions, Semaphores, Deadlock.

PROGRAMMING LANGUAGES AND TOOLS: DESIRED LANGUAGE

CHARACTERISTICS: Data typing; Control Structures; Packages; Exception Handling; Overloading; Multitasking; Task Scheduling; Timing specification; Programming environments; Runtime support.

Lab Experiments will be conducted using low power Microcontroller MSP 430

TEXT BOOKS:

1. **Embedded Systems Architecture; Programming and Design**-Rajkamal; Tata McGraw Hill Publications.
2. **Real-Time Systems Design and Analysis**--3rd Edition, Phillip A. Laplante. Apr 2004. Wiley-IEEE Press.
3. **Real - Time Computer Control- An Introduction** – Stuart Bennet,, 2nd Edn.

REFERENCE BOOKS:

1. **Real Time Systems**- C.M. Krishna, Kang G.Shin McGraw-Hill, 1997.
2. **An Embedded software primer**-David E Simon; Addison Wesley; 2000.
3. **An Introduction to Real Time Systems**-Raymond J.A. Buhr; Donald L. Bailey; Prentice Hall International; 1999.
4. **Embedded Real Time system**-Concepts, Design and Programming, Dr. K. V. K. K. Prasad Dream Tech Pres, New Delhi 2003.



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19
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Subject Title	COMPUTER COMMUNICATION NETWORKS	Credits	4
Sub.Code	11IT7GE5CN(EXCEPT TC,EC, M2)	L-T-P	4-0-0

Objective:

To understand the state-of-the-art in network protocols, architectures, and applications.

To understand network functional components and their interaction.

UNIT I

[10 hours]

INTRODUCTION: Uses of computer networks, Data communication, Circuit Switching, Packet Switching, Network Models, Example Networks, Network standardization. Theoretical basics of data communication, Layered tasks, OSI Model, Layers in OSI model, Functions, TCP/IP Suite, Addressing.

UNIT II

[12 hours]

DATA LINK CONTROL: Framing, Flow and error control, Protocols, Noiseless channels: Simplest protocol, Stop and wait protocol, Noisy channels: Stop and wait protocol ARQ, piggy backing, Go-Back-N ARQ, sliding window protocol, Selective repeat ARQ, HDLC, Point to point protocol.

Multiple accesses control: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA,
Controlled access: Reservation, Polling, and Token passing

UNIT III

[10 hours]

MEDIUM ACCESS SUB LAYER:

Static and dynamic channel allocation, multiple access protocols, LAN/MAN technology, Bus/Tree, Star and Ring topologies, The ring topology, Medium access control protocols, MAC performance, LAN/MAN standards, IEEE 802.2, 802.3, 802.4, IEEE802.5, 802.6, 802.11, and 802.16, Blue tooth

UNIT IV

[10 hours]



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NETWORK LAYER: Unicast Routing Protocols, Multicast Routing protocols, Logical addressing, Ipv4, Ipv6 format & addressing, Transition from Ipv4 to Ipv6, Delivery, Forwarding,

UNIT V

[10 hours]

TRANSPORT LAYER: Transport layer Process to process Delivery, UDP, TCP, SCTP, Congestion, Congestion Control, Examples, QOS, and Techniques to improve QOS.

APPLICATION LAYER: Client Server Model, Domain Name Space (DNS), Electronic mail, HTTP, world wide web (www)

TEXT BOOK:

1. Data communication and networking– Behrouz A. Forouzan, 4th Ed, TMH 2006.
2. William Stallings, Data and Computer Communications, Fifth edition, PHI, 1998.
3. Computer networks – Andrew. S. Tannenbaum

REFERENCE BOOKS:

1. Data communication and networking– Behrouz A. Forouzan, 3rd Ed, TMH 2006